MOTORCYCLE

2-STROKE SERVICE MANUAL

3rd EDITION VOL. 1

2-STROKE MOTORCYCLE SERVICE MANUAL

Third Edition Vol. 1

Includes:

Motorcycles

Moto Crossers

Motor Scooters

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Road Racers

Scramblers

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ENGINE TYPES

The engines used to power motorcycles and many other items of power equipment in use today are basically similar. All are technically known as "Internal Combustion Reciprocating Engines."

The source of power is heat formed by the burning of a combustible mixture, usually petroleum products and air. In a reciproating engine, this burning takes place in a closed cylinder containing a piston. Expansion resulting from the heat of combustion applies pressure on the piston to turn a shaft by means of a crank and connecting rod.

The fuel-air mixture may be ignited by means of an electric spark (Otto Cycle Engine) or by heat formed from compression of air in the engine cylinder (Diesel Cycle Engine). The complete series of events which must take place in order for the engine to run may occur in one revolution of the crankshaft (two strokes of the piston in cylinder) which is referred to as a "Two-Stroke Cycle Engine," or in two revolutions of the crankshaft (four strokes of the piston in cylinder) which is referred to as a "Four-Stroke Cycle Engine."

OTTO CYCLE. In a spark ignited engine, a series of five events is required in order for the engine to provide power. This series of events is called the "Cycle" (or "Work Cycle") and is repeated in each cylinder of the engine as long as work is being done. This series of events which comprise the "Cycle" is as follows:

1. The mixture of fuel and air is pushed into the cylinder by atmospheric pressure when the pressure within the engine cylinder is reduced by the piston moving downward in the cylinder (or by applying pressure to the fuel-air mixture as by crankcase compression in the crankcase of a "Two-Stroke Cycle Engine" which is described in a later paragraph).

2. The mixture of fuel and air is compressed by the piston moving upward in the cylinder.

3. The compressed fuel-air mixture is ignited by a timed electric spark.

4. The burning fuel-air mixture expands, forcing the piston downward in the cylinder thus converting the chemical energy generated by combustion into mechanical power.

5. The gaseous products formed by the burned fuel-air mixture are exhausted from the cylinder so that a new "Cycle" can begin.

The above described five events which comprise the work cycle of an engine are commonly referred to as (1), INTAKE; (2), COMPRESSION; (3), IGNITION; (4) EXPANSION (POWER); and (5), EXHAUST.

TWO STROKE CYCLE. Two stroke cycle engines may be of the Otto Cycle (spark ignition) or Diesel Cycle (compression ignition) type. However, since the two-stroke cycle engines listed in the repair section of this manual are all of the Otto Cycle type, operation of two-stroke Diesel Cycle engines will not be discussed in this section.

In two-stroke cycle engines, the piston is used as a sliding valve for the cylinder intake and exhaust ports. The intake and exhaust ports are both open when the piston is at the bottom of its downward stroke (bottom dead center or "B.D.C.") The exhaust port is open to atmospheric pressure; therefore, the fuel-air mixture must be elevated to a higher than atmospheric pressure in order for the mixture to enter the cylinder. As the crankshaft is turned from B.D.C. and the piston starts on its upward stroke, the intake and exhaust ports are closed and the fuel-air-mixture in the cylinder is compressed. When the piston is at or near the top of its upward stroke (top dead center or "T.D.C."), an electric spark across the electrode gap of the spark plug ignites the fuel air mixture. As the crankshaft turns past T.D.C. and the piston starts on its downward stroke, the rapidly burning fuel-air mixture expands and forces the piston downward. As the piston nears bottom of its downward stroke, the cylinder exhaust port is opened and the burned gaseous products from combustion of the fuel-air mixture flows out the open port. Slightly further downward travel of the piston opens the cylinder intake port and a fresh charge of fuel-air mixture is forced into the cylinder. Since the exhaust port remains open, the incoming flow of fuel-air mixture helps clean (scavenge) any remaining burned gaseous products from the cylinder. As the crankshaft turns past B.D.C. and the piston starts on its upward stroke, the cylinder intake and exhaust ports are closed and a new cycle begins.

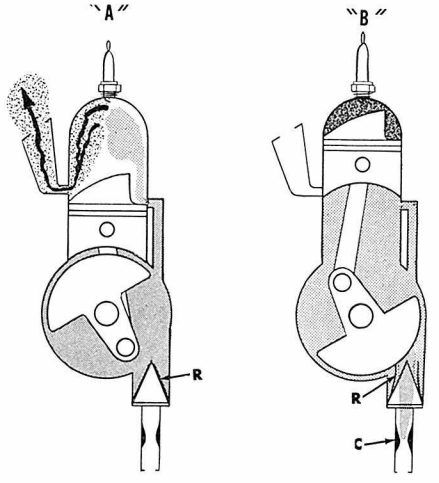


Fig. 1-1—Schematic diagram of a two-stroke cycle engine operating on the Otto Cycle (spark ignition). View "B" shows piston near top of upward stroke and atmospheric pressure is forcing air through carburetor (C), where fuel is mixed with the air, and the fuel-air mixture enters crankcase through open reed valve (R). In view "A", piston is near bottom of downward stroke and has opened the cylinder exhaust and intake ports; fuel-air mixture in crankcase has been compressed by downward stroke of engine and flows into cylinder through open port. Incoming mixture helps clean burned exhaust gases from cylinder.

Since the fuel-air mixture must be elevated to a higher than atmospheric pressure to enter the cylinder of a two-stroke cycle engine, a compressor pump must be used. Coincidentally, downward movement of the piston decreases the volume of the engine crankcase. Thus, a compressor pump is made available by sealing the engine crankcase and connecting the carburetor to a port in the crankcase. When the piston moves upward, volume of the crankcase is increased which lowers pressure within the crankcase to below atmospheric. Air will then be forced through the carburetor, where fuel is mixed with the air, and on into the engine crankcase. In order for downward movement of the piston to compress the fuel-air mixture in the crankcase, a valve must be provided to close the carburetor to crankcase port. Three different types of valves are used. In Fig. 1-1, a reed type inlet valve is shown in the schematic diagram of the two-stroke cycle engine. Spring steel reeds (R) are forced open by atmospheric pressure as shown in view "B" when the piston is on its

upward stroke and pressure in the crankcase is below atmospheric. When the piston reaches T.D.C., the reeds close as shown in view "A" and fuel-air mixture is trapped in the crankcase to be compressed by downward movement of the piston. In Fig. 1-2, a schematic diagram of a two-stroke cycle engine is shown in which the piston is utilized as a sliding carburetor - crankcase port (third port) valve. In Fig. 1-3, a schematic diagram of a two-stroke cycle engine is shown in which a slotted disc (rotary valve) attached to the engine crankshaft opens the carburetor-crankcase port when the piston is on its upward stroke. In each of the three basic designs shown, a transfer port (TP—Fig. 1-2) connects the crankcase compression chamber to the cylinder; the transfer port is the cylinder intake port through which the compressed fuel-air mixture in the crankcase is transferred to the cylinder when the piston is at bottom of stroke as shown in view "A."

Due to rapid movement of the fuel-air mixture through the crankcase, the crankcase cannot be used as a lubricating oil sump because the oil would be carried into the cylinder. Lubrication is accomplished by mixing a small amount of oil with the fuel or by a separate oil metering system. In either case, the engine lubricating oil is carried carried through the crankcase and eventually is forced into the combustion chamber where it is burned. Where an oil metering system is used, ratio of oil to fuel by volume is varied by throttle opening and engine speed. When oil is pre-mixed with the fuel, manufacturer's recommended fuel-oil ratio should be strictly observed.

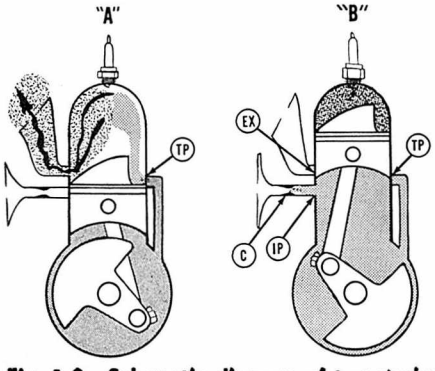


Fig. 1-2—Schematic diagram of two-stroke cycle engine operating on Otto Cycle. Engine differs from that shown in Fig. 1-1 in that piston is utilized as a sliding valve to open and close intake (carburetor to crankcase) port (IP) instead of using reed valve (R—Fig. 1-1).

C. Carburetor
EX. Exhaust port
IP. Intake port (carburetor to crankcase)
TP. Transfer port (crankcase to cylinder)

FOUR-STROKE CYCLE. In a four-stroke cycle engine operating on the Otto Cycle (spark ignition), the five events of the cycle take place in four strokes of the piston, or in two revolutions of the engine crankshaft. Thus, a power stroke occurs only on alternate downward strokes of the piston.

In view "A" of Fig. 1-4, the piston is on the first downward stroke of the cycle. The mechanically operated intake valve has opened the intake port and, as the downward movement of the piston has reduced the air pressure in the cylinder to below atmospheric pressure, air is forced through the carburetor, where fuel is mixed with the air, and into the cylinder through the open intake port. The intake valve remains open and the fuel-air mixture continues to flow into the cylinder until the piston reaches the bottom of its downward stroke. As the piston starts on its first upward stroke, the mechanically operated intake valve closes and, since the exhaust valve is closed, the fuel-air mixture is compressed as in view "B."

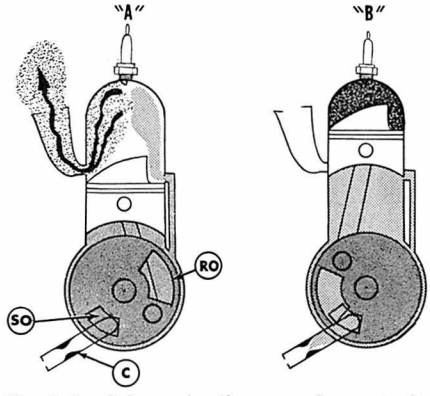


Fig. 1-3—Schematic diagram of two-stroke cycle engine similar to those shown in Figs. 1-1 and 1-2 except that a rotary carburetor to crankcase port valve is used. Disc driven by crankshaft has rotating opening (RO) which uncovers stationary opening (SO) in crankcase when piston is on upward stroke. Carburetor is (C).

Just before the piston reaches the top of its first upward stroke, a spark at the spark plug electrodes ignites the compressed fuel-air mixture. As the engine crankshaft turns past top center, the burning fuel-air mixture expands rapidly and forces the piston downward on its power stroke as shown in view "C." As the piston reaches the bottom of the power stroke, the mechanically operated exhaust valve starts to open and as the pressure of the burned fuel-air mixture is higher than atmospheric pressure, it starts to flow out the open exhaust port. As the engine crankshaft turns past bottom center, the exhaust valve is almost completely open and remains open during the upward stroke of the piston as shown in view "D." Upward movement of the piston pushes the remaining burned fuel-air mixture out of the exhaust port. Just before the piston reaches the top of its second upward or ex-

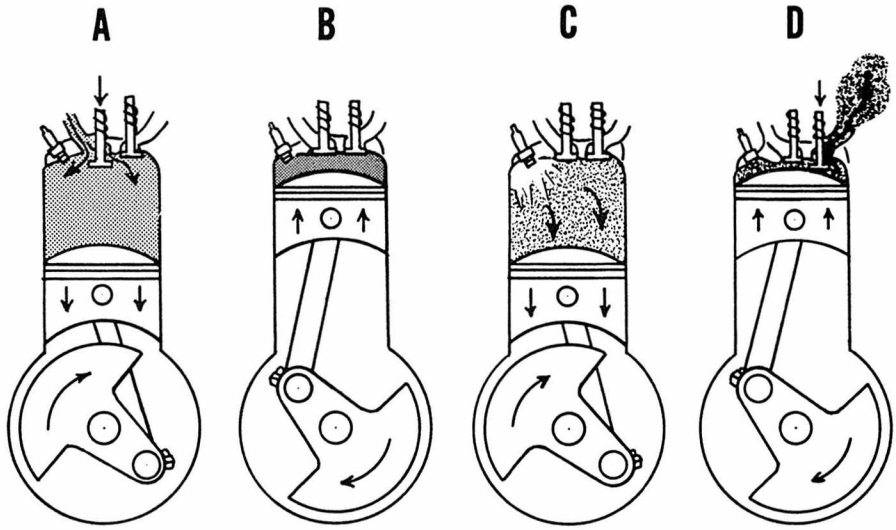


Fig. 1-4—Schematic diagram of four-stroke cycle engine operating on the Otto (spark ignition) cycle. In view "A", piston is on first downward (intake) stroke and atmospheric pressure is forcing fuel-air mixture from carburetor into cylinder through the open intake valve. In view "B", both valves ae closed and piston is on its first upward stroke compressing the fuel-air mixture in cylinder. In view "C", spark across electrodes of spark plug has ignited fuel-air mixture and heat of combustion rapidly expands the burning gaseous mixture forcing the piston on its second downward (expansion or power) stroke. In view "D", exhaust valve is open and piston on its second upward (exhaust) stroke forces the burned mixture from cylinder. A new cycle then starts as in view "A".

haust stroke, the intake valve opens and the exhaust valve closes. The cycle is completed as the crankshaft turns past top center and a new cycle begins as the piston starts downward as shown in view "A."

In a four-stroke cycle engine operating on the Diesel Cycle, the sequence of events of the cycle is similar to that described for operation on the Otto Cycle, but with the following exceptions: On the intake stroke, air only is taken into the cylinder. On the compression stroke, the air is highly compressed which raises the temperature of the air. Just before the piston reaches top dead center, fuel is injected into the cylinder and is ignited by the heated, compressed air. The remainder of the cycle is similar to that of the Otto Cycle.

CARBURETORS

Function of the carburetor on a spark-ignition engine is to atomize the fuel and mix the atomized fuel in proper proportions with air flowing to the engine intake port or intake manifold. Carburetors used on engines that are to be operated at constant speeds and under even loads are of simple design since they only have to mix fuel and air in a relatively constant ratio. On engines operating at varying speeds and loads, the carburetors must be more complex because different fuel-air mixtures are required to met the varying demands of the engine.

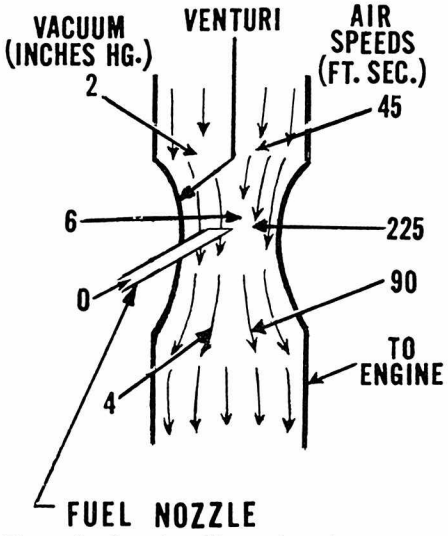


Fig. 1-5—Drawing illustrating the venturi principle upon which carburetor design is based. Figures at left are inches of mercury vacuum and those at right are air speeds in feet per second that are typical of conditions found in a carburetor operating at wide open throttle. Zero vacuum in fuel nozzle corresponds to atmospheric pressure.

Requirements

To meet the demands of an engine being operated at varying speeds and loads, the carburetor must mix fuel and air at different mixture ratios. Gasoline-air mixture ratios required for different operating conditions are approximately as follows:

	Fuel	Air
Starting, cold weather	1 lb.	7 lbs.
Accelerating	1 lb.	9 lbs.
Idling (no load)	1 lb.	11 lbs.
Part open throttle	1 lb.	15 lbs.
Full load, open throttle	1 lb.	13 lbs.

Basic Design

Carburetor design is based on the venturi principle which simply means that a gas or liquid flowing through a necked-down section (venturi) in a passage undergoes an increase in velocity (speed) and a decrease in pressure as compared to the velocity and pressure in full size sections of the passage. The principle is illustrated in Fig. 1-5, which shows air passing through a carburetor venturi. The figures given for air speeds and vacuum are approximate for a typical wide-open throttle operating condition. Due to low pressure (high vacuum) in the venturi, fuel is forced out through the fuel nozzle by the atmospheric pressure (0 vacuum) on the fuel; as fuel is emitted from the nozzle, it is atomized by the high velocity air flow and mixes with the air.

Although some carburetors may be very basic, the varying requirements of motorcycle engines make it necessary to incorporate features to provide variable fuel-air ratios for different operating conditions. These design features will be described in the following paragraphs which outline the different carburetor types.

Carburetor Types

Carburetors used on motorcycles are usually classified by type of throttle valve, venturi and starting (enriching) method used. The following paragraphs describe the different operating principles. Various combinations of the following features are used in each motorcycle carburetor.

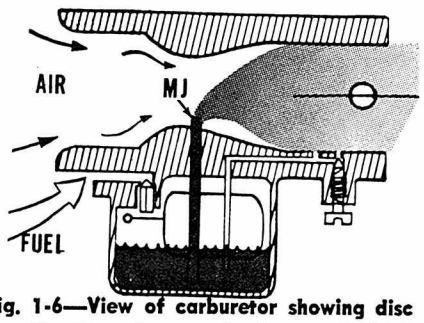


Fig. 1-6—View of carburetor showing disc type throttle valve completely open for high speed operation.

THROTTLE VALVES. In order to vary the speed, a valve is installed between the fuel nozzle and engine which limits the volume of combustible mixture available to the combustion chamber. When less mixture is available to the combustion area, there will be less expansion resulting in less rpm and less power. The two types of throttle valves commonly used are the disc (butterfly) valve (Fig. 1-6) and the variable venturi (slide) valve (Fig. 1-9).

If, after the engine has been started, the throttle valve is in the wide-open position, the engine can obtain enough fuel and air to run at dangerously high speeds so the throttle valve must be partly closed. At no load, the engine requires very little air and fuel to run at its rated speed and the throttle must be moved nearer the closed position. As more load is placed on the engine, more fuel and air mixture is required for the engine to operate at its rated speed. When the engine is required to develop maximum power or speed, the throttle must be in the wide open position.

DISC (BUTTERFLY) VALVE. A typical disc type throttle valve is shown in Figs. 1-6, 1-7 and 1-8. As the throttle disc is turned, the opening of the throttle bore is decreased. When disc is in position shown in Fig. 1-8, the throttle opening is nearly closed. Idle speed adjustment is ac-

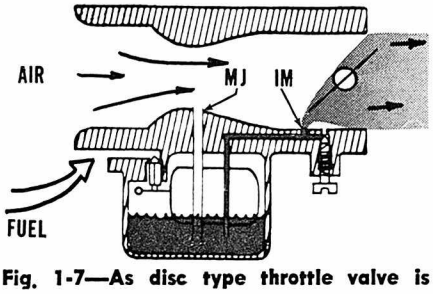


Fig. 1-7—As disc type throttle valve is moved toward the closed position, vacuum at the main jet (MJ) may not be enough to draw fuel into the passing air and an intermediate jet (IM) is provided.

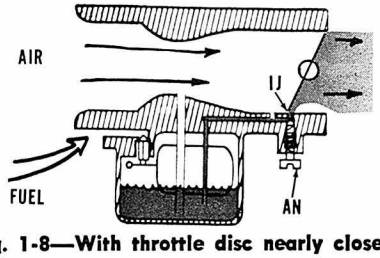


Fig. 1-8—With throttle disc nearly closed, the idle jet (IJ) is used. Usually an adjustment needle (AN) is provided to adjust the idle mixture fuel-air ratio.

complished by stopping rotation of the valve before throttle bore is completely closed. When throttle is nearly closed, vacuum at the venturi is insufficient to provide correct fuel-air ratio by using only one fuel nozzle. Usually an additional idle jet (Fig. 1-8) and intermediate jet (Fig. 1-7 are incorporated.

VARIABLE VENTURI (SLIDE) VALVE. A typical slide type carburetor is shown in Fig. 1-9. When the slide is completely open, the small step in the throttle bore serves as a large diameter venturi for high speed. As the slide is lowered, the venturi size is decreased as shown in Fig. 1-10. Decreasing the venturi size slows the speed by decreasing the amount of fuel and air mixture that can be drawn into the engine and also increases the vacuum at the venturi fuel nozzle. A valve needle attached to the throttle slide is incorporated to lower the amount of fuel drawn in by the high vacuum created by the small venturi. An idle jet is sometimes installed as shown in Fig. 1-10 to provide an additional mixture adjustment for low speed settings. Idle speed is controlled by stopping the throttle slide before it completely closes the throttle bore. If the valve needle is raised in the throttle slide, it will increase the fuel flow from the main nozzle at intermediate throttle settings.

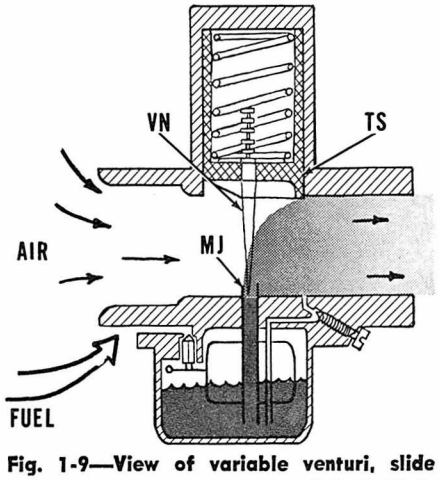


Fig. 1-9—View of variable venturi, slide type throttle valve. Throttle slide (TS) is in the fully raised high speed position. Valve needle (VN) is raised allowing main jet (MJ) to be completely open.

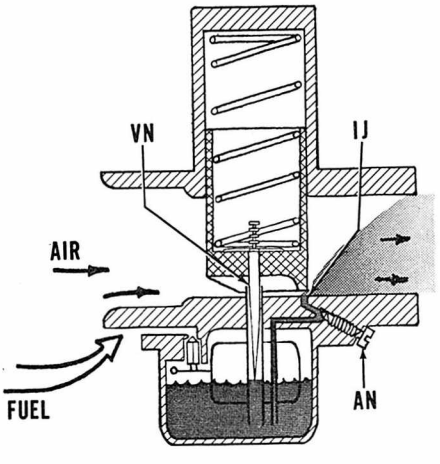


Fig. 1-10—With throttle slide lowered to idle speed position, only a small amount of air is allowed to pass. The valve needle (VN) is lowered, closing the main jet and fuel is drawn from the idle jet (IJ). Idle mixture adjustment needle (AN) controls fuel-air ratio.

VENTURI. As previously explained, a gas or liquid flowing through a necked-down section (venturi) in a passage increases in velocity (speed) and decreases in pressure as shown in Fig. 1-5. When movement of the piston draws air through the carburetor, this change of pressure is what causes the fuel to be drawn into the air as it passes the fuel nozzle. The venturi must be matched to the engine to provide the right amount of pressure drop at the venturi for correct fuel-air mixture. Some adjustment can be accomplished by making the fuel flow less (or more) restricted by changing the jet sizes; however, manufacturer's recommendation of carburetor and jet sizes should be closely followed.

VARIABLE VENTURI (SLIDE) VALVE. The sliding variable venturi that is commonly used as a throttle is explained in a previous paragraph. If a larger carburetor of this same type is installed, it is possible that low speed (part throttle) operation will function normally, but at full open throttle the venturi will be too large to provide the correct fuel-air mixture.

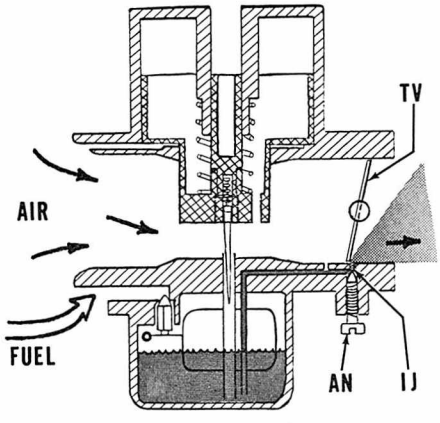


Fig. 1-11—View of vacuum controlled variable venture type carburetor with throttle valve (TV) nearly closed. Idle mixture adjustment needle (AN) is shown. Fuel is discharged from idle jet (IJ).

VACUUM CONTROLLED VENTURI. Some models utilize a vacuum controlled, variable venturi as shown in Fig. 1-11. These models use a disc type throttle plate which controls the amount of fuel-air mixture available to the engine. When the engine is running at slow speed (throttle nearly closed) the venturi piston is lowered as shown in Fig. 1-11. As the throttle disc is opened Fig. 1-12 and 1-13 the vacuum at the venturi is transferred into chamber (V) via port (P) and atmospheric pressure is admitted under venturi piston via port (A). The high pressure below the venturi and low pressure above causes the piston to raise as shown in Figs. 1-12 and 1-13. As with the slide type variable venturi, a valve needle is attached to the venturi to limit the amount of fuel drawn from the main nozzle at low speed. An idle mixture jet (IJ—Fig. 1-11) and intermediate jet (IM—Fig. 1-12) are provided to correct the fuel to air ratio throughout the entire speed range. It is extremely important that the venturi piston is free to

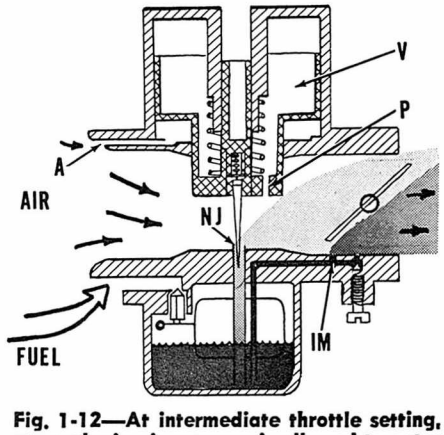


Fig. 1-12—At intermediate throttle setting, atmospheric air pressure is allowed to enter port (A) under the venturi piston and venturi vacuum is transferred to top of piston (V) via port (P). The vacuum above the piston and atmospheric pressure below, causes the venturi piston to raise. Fuel is discharged at partially open needle jet (NJ) and intermediate jet (IM).

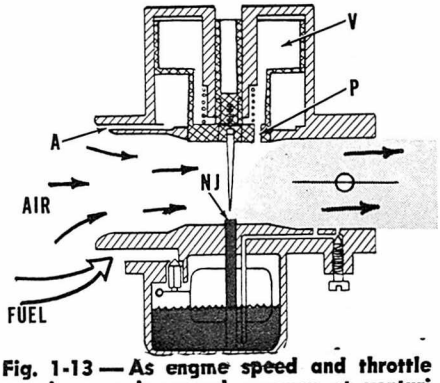


Fig. 1-13 — As engine speed and throttle opening are increased, vacuum at venturi port (P) and above venturi piston (V) increases until venturi is completely open. Needle jet (NJ) is completely open.

move easily in its bore and that it fits tightly enough to seal the different pressures. Idle speed is controlled by stopping the throttle disc before it closes the throttle bore.

STARTING ENRICHMENT. The ratio of fuel to air must be much richer when starting in cold weather than when running at full open throttle. Two methods of obtaining a rich starting mixture are commonly used.

CHOKE PLATE. Fig. 1-14 shows a typical choke plate installation in relation to the carburetor venturi.

At cranking speeds, air flows through the carburetor venturi at a slow speed; thus, the pressure in the venturi does not usually decrease to the extent that atmospheric pressure on the fuel will force enough fuel from the nozzle. If the choke plate is closed as shown by the broken line in Fig. 1-14, air cannot enter into the carburetor and pressure in the carburetor decreases greatly as the engine is turned at cranking speed. Fuel is then forced from the fuel nozzle. In manufacturing the carbuetor choke plate or disc, a small hole or notch is cut in the plate so that some air can flow through the plate when it is in closed position to provide air for the starting fuel-air mixture. In some instances after starting a cold engine, it is advantageous to leave the choke plate in a partly closed position as

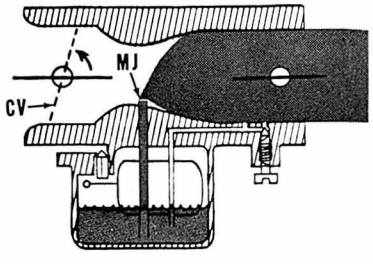


Fig. 1-14—As choke valve (CV) is closed as shown by the broken lines, vacuum is increased at main jet (MJ).

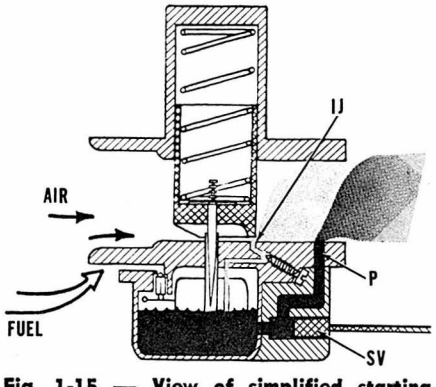


Fig. 1-15 — View of simplified starting valve enrichment method. With starting valve (SV) open, the normal idle mixture supplied by idle jet (IJ) is further enriched by starting port (P).

the restriction of air flow will decrease the air pressure in carburetor venturi, thus causing more fuel to flow from the nozzle resulting in a richer fuel-air mixture. The choke plate or disc should be in fully open position for normal engine operation.

STARTING VALVE. Fig. 1-15 shows a simplified starting system typical of the type found in many carburetors. A combination of two principles is utilized to enrich the fuel-air mixture. First, the passage is normally less restricted (larger) than the normal idle passage and second, the starting port is located between the throttle slide and engine. With the starting port (P) located as shown in Fig. 1-15, closing the throttle slide increases the vacuum at the starting port in much the same way as the choke plate previously described. It is obvious that this rich mixture should not normally be used, so a shut-off valve is incorporated in the system. The starter jet shut-off valve (SV—Fig. 1-15) is sometimes actuated by a control on the carburetor; however, is often remote controlled by a handle bar mounted lever via a control cable.

IGNITION SYSTEM

The timed spark which ignites the fuel charge in the cylinder may be supplied by either a magneto or battery ignition system. To better understand the operation of the components and the differences and similarieties of the two systems, they will be combined in this section and the functions of the various units explained and compared.

Theory

In the modern ignition system, a relatively weak electric current of 6 to 12 volts and 2 to 5 amperes is transformed into a momentary charge of minute amperage and extremely high (10,000-25,000) voltage, capable of jumping the spark plug gap in the cylinder and igniting the fuel charge.

To understand the ignition system theory, electricity can be thought of as a stream of electrons flowing through a conductor. The force of the stream can be increased by restricting volume, or the volume increased by reducing the resistance to movement; but the total amount of power cannot be increased except by employing additional outside force. The current has an inertia of motion and resists being stopped once it has started flowing. If the circuit is broken suddenly, the force will tend to pile up temporarily, attempting to convert the speed of flow into energy.

A short list of useful electrical terms and a brief explanation of their meanings is as follows:

AMPERE. The unit of measurement used to designate the amount, or quantity of flow of an electrical current.

OHM. The unit of measurement used to designate the resistance of a conductor to the flow of current.

VOLT. The unit of measurement used to designate the force, or pressure of an electrical current.

WATT. The unit of measurement which designates the ability of an electrical current to perform work; or to measure the amount of work performed.

The four terms are directly interrelated, one ampere equaling the flow of current produced by one volt against a resistance of one ohm. One watt designates the work potential of one ampere at one volt in one second.

Ignition Coil

When an electrical current is flowing through a conductor, a magnetic field exists at right angles to the current flow. As long as the conductor is relatively straight, nothing much happens; but if the conductor is coiled around a soft iron core, then the length of the iron core is at approximately right angles to the wire. A path is provided for the magnetic field and the iron core becomes a magnet as long as the current flows.

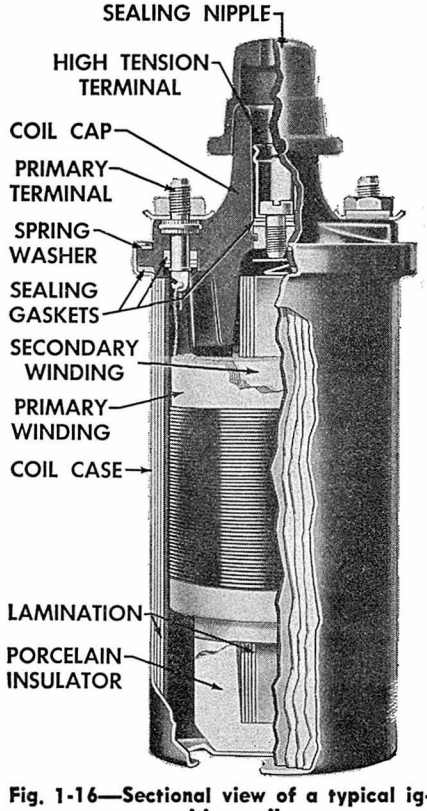


Fig. 1-16—Sectional view of a typical ignition coil.

A second phenomenon of electrical action is that when a magnetic field is interrupted, a pulsation of electrical energy is formed at right angles to the lines of magnetic flow.

In a battery ignition system, these two peculiarities are combined to form an ignition coil as shown in Fig. 1-16. The inner and outer laminations are composed of soft iron and form a continuous path for a magnetic field. Around the inner laminations but insulated from it, is wound many coils of fine copper wire. Around this coil of fine wire, but insulated from it and the iron core, are fewer turns of heavier copper wire. These windings are encased in the outer laminations, then in a protective case.

The outer winding of heavier wire is connected to the two screw terminals on the coil case and form the primary cirucuit of the coil. The inner winding of fine wire is grounded at one end while the other end is connected to the insulated, high tension terminal and forms the secondary circuit.

Primary Circuit

The primary circuit is attached to the power source in both the battery and magneto electrical system.

In the battery system, the primary circuit consists of the battery, ignition switch, primary windings, contact points, condenser, and the necessary connecting wiring as shown at (3—Fig. 1-18). When the ignition switch (2) and contact points (6) are closed, the primary circuit (3), primary windings of coil (4) and the closed contact points (6), the ground connections (G1 at battery and G2 at points) plus the engine casting or frame, complete the circuit. As the current flows, a magnetic field is built up in the soft iron laminations of coil (4), which is surrounded by the primary and secondary windings. When contact points (6) open to break the circuit, the current tries to flow through the path of least resistance which is the condenser (5) until condenser capacity is reached; then, the primary current ceases to flow and the magnetic field starts to collapse. This collapse is hastened by the condenser, which tries to discharge its stored energy backward through the primary circuit. When the magnetic field collapses, extremely high voltage is induced in the coil secondary windings which flows through secondary circuit (7) to spark plug (8), where it jumps the plug gap and is dissipated in the engine frame through ground (G4).

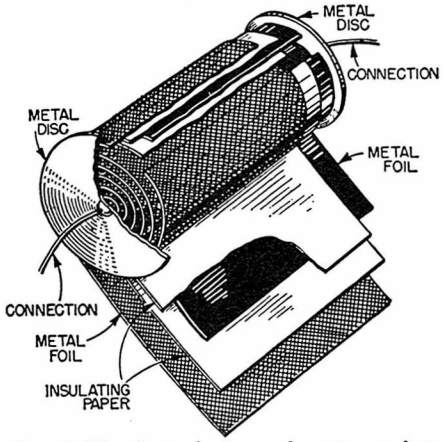


Fig. 1-17—A typical condenser consists of two metal conductors separated by layers of insulating paper and rolled into a tight cylinder.

In a magneto ignition system, the same principles are involved but the method of application is somewhat different. Instead of stored chemical energy of a battery which produces a constant direct current, the source of energy is a pulsating alternating current induced in the magneto primary windings and derived from permanent magnets. Because of variation in voltage and direction of current flow (See Fig. 1-19) the ignition points must not only be correctly timed with relation to the piston, but also to break at or near peak voltage. The proper position with relation to the position of the permanent magnet is decided by laboratory tests and sometimes becomes a part of the service specifications. This position is referred to as "edge gap."

Secondary Circuit

The secondary circuit carries the high voltage current from the coil to the spark plug or plugs. The secondary circuit ground at the spark plug should be of negative polarity. On systems with a separate high tension coil, the secondary current polarity can be reversed by changing the primary circuit leads at the coil or by reversing the connections. The potential voltage available in the secondary circuit where the system is in good condition may be 18,000 to 25,000 volts. The actual voltage depends on the resistance of the secondary circuit, and the type and condition of the spark plug plays an important part in establishing the operating resistance. When the secondary current is induced in the coil, current strength continues to build up until a spark is formed across the plug gap, then the energy will be dissipated and voltage will rise no higher.

Spark Plug

In any spark ignition engine, the spark plug provides the means for igniting the compressed fuel-air mixture in the cylinder. Before an electric charge can move across an air gap, the intervening air must be charged with electricity, or ionized. The spark plug gap becomes more easily ionized if the spark plug ground (G4—Fig. 1-18) is of negative polarity. If the spark plug is properly gapped and the system is not shorted, not more than 7,000 volts may be required to initiate a spark. Higher voltage is required as the spark plug warms up, or if compression pressures or the distance of the air gap is increased. Compression pressures are highest at full throttle and relatively slow engine speeds, therefore, high voltage requirements or a lack of available secondary voltage most often shows up as a miss during maximum acceleration from a slow engine speed. There are many different types and sizes of spark plugs which are designed for a number of specific requirements.

THREAD SIZE. The threaded, shell portion of the spark plug and the attaching holes in the cylinder are manufactured to meet certain industry established standards. The diameter is referred to as "Thread Size." Those commonly used are: 10 mm, 14 mm, 18 mm, ⅞ inch and ½ inch pipe.

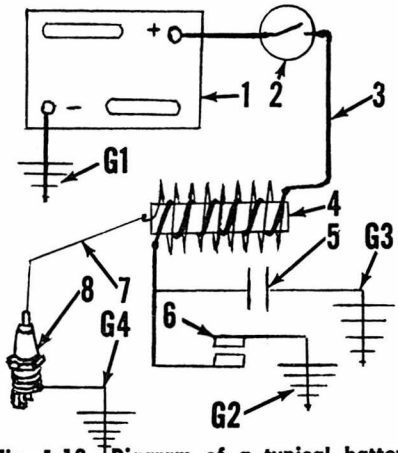


Fig. 1-18—Diagram of a typical battery ignition system. Refer to text for principles of operation.

1. Battery
2. Ignition switch
3. Primary circuit
4. Ignition coil
5. Condenser
6. Contact points
7. Secondary circuit
8. Spark plug

G1 thru G4. Ground connections

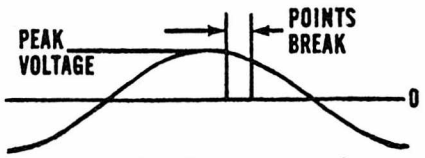


Fig. 1-19 — The primary current of a magneto ignition system is an alternating current, thus voltage varies from zero to a predetermined peak during each positive and negative cycle. To produce an adequate spark to ignite the fuel charge, the contact points must break at or near the voltage peak as shown.

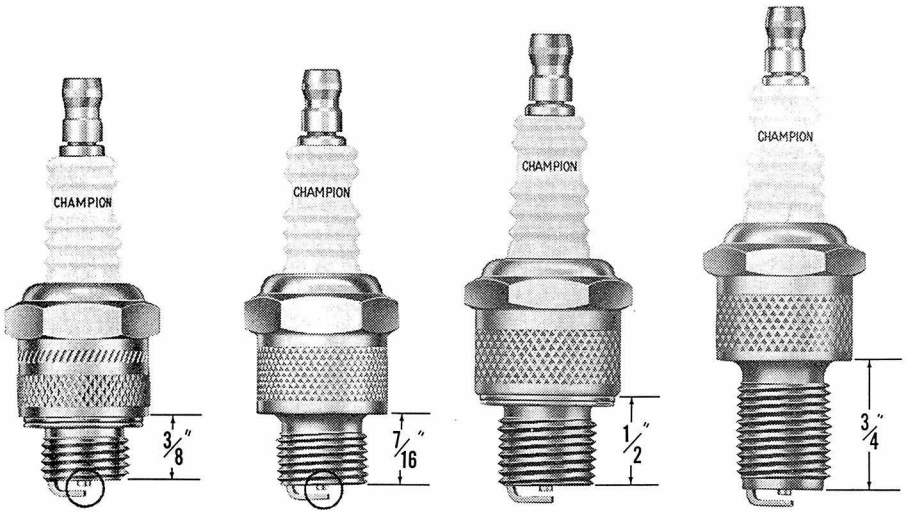


Fig. 1-20—Views showing spark plugs of various "reaches". A 3/8-inch reach spark plug measures 3/8-inch from firing end of shell to gasket surface of shell. The two plugs at left side illustrate the difference in plugs normally used in two-stroke cycle and four-stroke cycle engines; refer to the circled electrodes. Spark plug at left has a shortened ground electrode. The short ground electrode will operate cooler than longer ground electrode.

REACH. The length of thread, and the thread depth in cylinder head or wall are also standardized throughout the industry. This dimension is measured from gasket seat of plug to cylinder end of thread.

HEAT RANGE. During engine operation, part of the heat generated during combustion is transferred to the spark plug, and from the plug to the cooling medium through the shell threads and gasket. The operating temperature of the spark plug plays an important part in engine operation. If too much heat is retained by the plug, the fuel-air mixture may be ignited by contact with the heated surface before the ignition spark occurs. If not enough heat is retained, partially burned combustion products (soot, carbon and oil) may build up on the plug tip resulting in "fouling" or shorting out of the plug. If this happens, the secondary current is dissipated uselessly as it is generated instead of bridging the plug gap as a useful spark, and the engine will misfire.

The operating temperature of the plug tip can be controlled, within limits, by altering the length of the path the heat must follow to reach the threads and gasket of the plug. Thus, a plug with a short, stubby insulator around the center electrode will run cooler than one with a long slim insulator. Most plugs in the more popular sizes are available in a number of heat ranges which are interchangeable within the group. The proper heat range is determined by engine design and the type of service. Like most other elements of design, the plug type installed as original equipment is usually a compromise and is either the most suitable plug for average conditions; or the best plug to meet the two extremes of service expected. No one spark plug, however, can be ideally suited for long period of slow-speed operation and still be the best possible type for high-speed operation.

IDENTIFICATION. Each spark plug manufacturer uses a different special code to identify spark plug characteristics. It is impossible to provide a plug cross reference chart which is accepted by all manufacturers; however, the following code identification for some spark plugs may be helpful for selecting the correct plug. The plug listed may not be a valid type, but is used for explanation only.

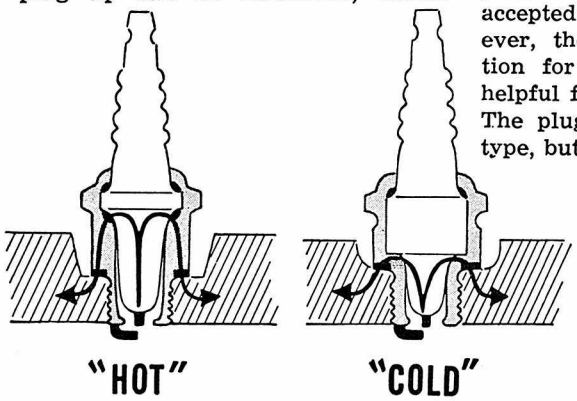
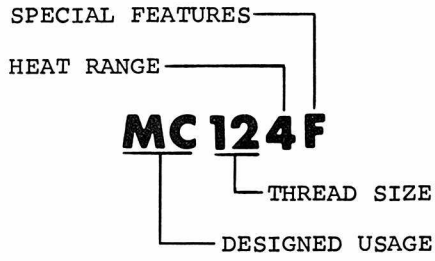


Fig. 1-21—Spark plug tip temperature is controlled by the length of the path heat must travel to reach cooling surface of the engine cylinder head.

AC—SPARK PLUGS



Thread Size (12)—The first part of numbers indicates thread size. The example "12" indicates that plug thread size is 12 MM.

First number 2 is ½ inch thread size.
First number 4 is 14 MM thread size.
First number 7 is ⅞ inch thread size.
First number 8 is 18 MM thread size.
First number 10 is 10 MM thread size.
First number 12 is 12 MM thread size.

Heat Range (4)—The last number indicates heat range.

Number 0 or 1 is usually the coldest available in that type of plug. The Example "4" is approximately mid-range.
Last number 9 is extremely hot plug.
Last number 0 or 1 is extremely cold plug.

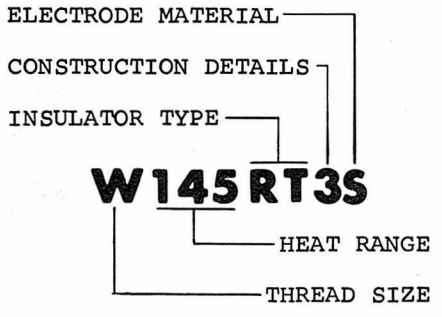
Suffix Letters (F)—Letter (or letters) after number indicates special features. The "F" in example indicates that plug is "Special reach for Foreign Applications".

B—Neon tube
D—Dual side electrodes
E—Engineer Corps., Shielded (Not an Aircraft type)
F—Special reach for Foreign Applications
FF—½" reach fully threaded (14 MM)
G—Marine racing gap
H—Special hex size
I—Iridium center electrode
K—Hi-Perf. Marine non-racing gap
L—Long reach (7/16" for 14 MM, ¾" for 18 MM)
XL—Extra Long reach (¾" for 14 MM)
N—Extra long reach (14 MM) (¾" reach with ⅜" thread length)
P—Platinum electrodes
R—Resistor
S—(14 MM) Extended tip
S—(⅞") Moderate long reach (23/32")
T—Tapered engine seat
TS—Tapered seat with extended tip
W—Recessed termination
X—Special gap
Y—3 prong cloverleaf electrode

Prefix Letters (MC)—Letter (or letters) before numbers indicates designed usage. Many times a standard plug (without MC) will be suitable for motorcycle use and will not be marked "MC."

B—Series gap
C—Commercial
CS—Low profile
G—Gas Engine
H—High altitude or weatherproof (shield connector, ¾-20 thread)
M—Marine
MC—Motorcycle type
LM—Lawn mower type
R—Resistor
S—Shielded (⅝-24 thread)
SN—Snow
TC—Tractor Commercial
V—Surface Gap
W—Water proof (shield connector, ⅝-24 thread)

BOSCH-SPARK PLUGS



Thread Size (W)—The first letter (or letters) indicates thread size and general type of plug. The example "W" is 14 MM.

M, MA, MG, MV, MAG and MGV .....18 MM
U .....10 MM
W, WD, WG, WK and WKA 14 MM
X .....12 MM
Z .....⅞ inch—18

Thread size codes MA and MAG are tapered seat; WK and WKA are short plugs; WD type is surface gap plug.

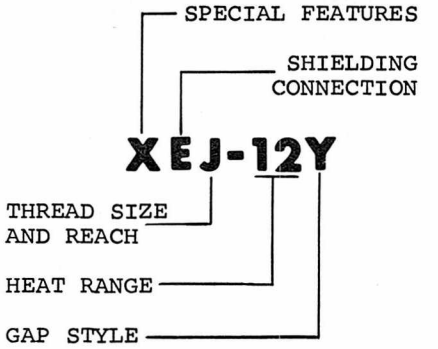
Heat Range (145)—The number indicates plug heat range between 20 (hot) to 340 (cold). Example of "145" is approximately mid-range.

Insulator Type (RT)—The letter "R" indicates resistor type plug. The letter "T" indicates insulator material.

Construction Details (3)—Variations in construction including thread length; regular or extended tip, side electrode, etc.

Electrode Material (S)—The letter "S" indicates silver electrode material and "P" indicates platinum tipped electrode.

CHAMPION-SPARK PLUGS



Heat Range (12)—The heat range numbers are divided into four types. Number 1-25 are for automotive, marine and ordinance plugs; numbers 26-50 are for aircraft; numbers 51-75 are racing plugs; numbers 76-99 indicate special features or application. On all types, the higher number (within type range) indicates hotter plug.

Thread Size and Reach (J)—The code letter "J" in the example indicates 14 MM thread size with ⅜ inch reach.

Letter	Thread Size	Thread Reach (Inch)
Y	10 mm	¼
Z	10 mm	.492
G	10 mm	.700
P	12 mm	.492
R	12 mm	¾
J	14 mm	⅜
J (When preceded by C)	14 mm	⅜
J (When preceded by D)	14 mm	.325 Tapered Seat
H	14 mm	7/16
L	14 mm	½ or .472
L (When preceded by B)	14 mm	.460 Tapered Seat
N	14 mm	¾
N (When preceded by B)	14 mm	.708 Tapered Seat
E	14 mm	.680
F	18 mm	.460 Tapered Seat
D	18 mm	½
M	18 mm	½
K	18 mm	All
B	18 mm	13/16
U	18 mm	1⅛
W	⅞"-18	All
C	⅞"-18	All
S	1⅛"-12	.600
None	½"-14 Pipe Thread	All
V	Model Airplane Engine Plug	

Type of Shielding Connection (E)—In some cases indicates special short plugs. If this code is not used, plug is not shielded and is not a short plug. Example "E" indicates shielded spark plug with ⅝ inch—24 threaded connection.

B—See Thread Size Code L & N
C—(See thread Size Code J) Short plug, Bantam
D—(See thread Size Code J) Short plug
E—Shielded ⅝ inch-24
H—Shielded ¾ inch-20
M—Shielded ⅝ inch-24 Ordinance
P—Shielded 9/16 inch-27
S—Shielded 11/16 inch-24 Whitworth
T—Low Profile plug Shorty
W—Shielded 13/16 inch-20

Special Internal Features (X)—Indicates resistor or auxiliary gap. If this code is not present, plug is not resistor or auxiliary gap type.

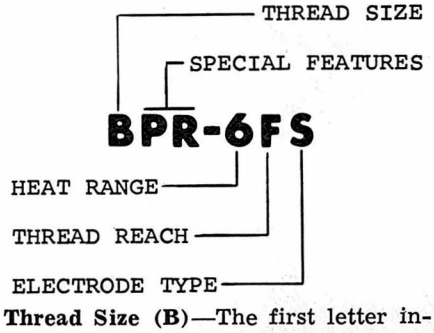
R—Resistor (less than 6000 ohms)
X—Resistor (more than 6000 ohms)
U—Auxiliary gap

Gap Style (Y)—Suffix letters indicate type of electrodes and type of gap. Letter "Y" in the example indicates projected core ("Turbo-Action") gap style.

B—Two heavy duty ground electrodes
C—Protruding nose, Round ground electrode, Sawed gap
D—Protruding nose, Round ground electrode
F—Three heavy duty ground electrodes
G—"Gold Palladium" center electrode
J—Cut back ground electrode
LM—Special Lawn Mower
N—Four prong Aircraft type
P—Fine wire Platinum electrodes
R—Push wire ground electrode
S—Single ground electrode at side of center electrode
T—Kiekhaefer Gap
V—Surface Gap
Y—Projected core nose

NOTE: The Champion Spark Plug Company suggests using "Gold Palladium" type (suffix G) plug for most motorcycle applications.

NGK SPARK PLUGS



Thread Size (B)—The first letter indicates thread size. The second and third letters (if used) indicate variations. Projected insulator plugs are

indicated by using "P" as second letter. Resistor plugs are indicated by using "R" and low profile plugs are indicated by "M" as the second or third letter.

A ..... 18 MM
AB ..... 18 MM ($\frac{13}{16}$ inch Hex)
B ..... 14 MM
C ..... 10 MM
D ..... 12 MM

Heat Range (6)—The number indicates the heat range. Numbers are from 2 (hot) to 14 (cold). Number "6" of the example is approximately mid-range.

Thread Reach—Three suffix letters (E, H & L) are used to indicate thread reach. If none of the above letters appear on 14mm plug, reach is $\frac{3}{8}$ inch; if none appear on 18mm plug, reach is 12mm. Letter "F" in suffix (example) indicates taper seat.

E ..... $\frac{3}{4}$ inch Reach
F ..... Taper Seat
H ..... $\frac{1}{2}$ inch Reach
L ..... $\frac{7}{16}$ inch Reach

Electrode Type (S)—Special electrodes are identified by last letter. Example "S" is "Super Wide Range Electrode".

C .....Competition type electrode
N ..Racing type (Nickel) electrode
P Racing type (Platinum) electrode
S .....Super wide range electrode
X .....Surface gap electrode

ALLSTATE

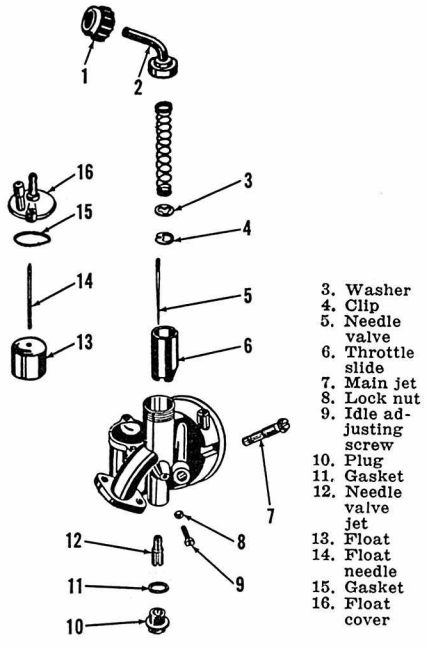
SEARS, ROEBUCK AND CO.
U.S.A.

SIMPSONS-SEARS, LTD.
CANADA

50 AND 60CC MODELS

MODEL	Mo-Ped	Campus 50	Saber	Sport 60, Cheyenne	Motor Scooter
Displacement-cc	49	49	49	59.6	59.6
Bore-MM	38	38	38	42	42
Stroke-MM	43	43	43	43	43
Number of cylinders	1	1	1	1	1
Oil-fuel ratio	1 to 25	1 to 25	1 to 25	1 to 25	1 to 25
Plug gap-inch	0.020	0.020	0.020	0.020	0.020
Point gap-inch	0.016	0.016	0.016	0.016	0.016
Ignition timing—Advance	Fixed	Fixed	Fixed	Fixed	Fixed
Inches BTDC	0.071	0.071	0.071	0.039	0.043
Electrical system voltage	6	6	6	6	6
Tire size	2.25 X 23	2.25 X 23	2.25 X 23	2.25 X 23	3.00 X 12
Tire pressure psi-front	25	25	25	25	20
rear	32	32	32	32	25*
Chain free play-inch	½	½	½	½	½
Number of speeds	2	3	3	3	3
Weight lbs. (approx.)	115	118	140	141	150

*32 psi with two riders



3. Washer
4. Clip
5. Needle valve
6. Throttle slide
7. Main jet
8. Lock nut
9. Idle adjusting screw
10. Plug
11. Gasket
12. Needle valve jet
13. Float
14. Float needle
15. Gasket
16. Float cover

Fig. A1-1—Exploded view of Bing 1/12 carburetor.

MAINTENANCE

SPARK PLUG. Spark plug electrode gap is 0.5 MM (0.020 in.) for all models. Refer to the following chart for correct type of plug.

Model	Allstate	Champion
Mo-Ped	60410	L-7
Motor Scooter	60400	L-7
Other Models	902.0727	L-5

CARBURETOR. Mo-Ped 50 models use a Bing 1/12 carburetor shown in Fig. A1-1. Main jet (7) is usually size 62; however, for better fuel economy, size 60 main jet may be installed. Needle valve clip (4) should be installed in second groove from top of needle (5). Make certain washer (3) is installed. Idle speed screw (9) should be locked by nut (8).

All models except Mo-Ped 50 use Bing 1/17 carburetor shown in Fig. A1-2. Main jet (12) size is normally No. 90 for Sport Mo-Ped and 84 for Motor Scooters; however, other sizes may be used for better fuel economy or slightly better performance. Clip

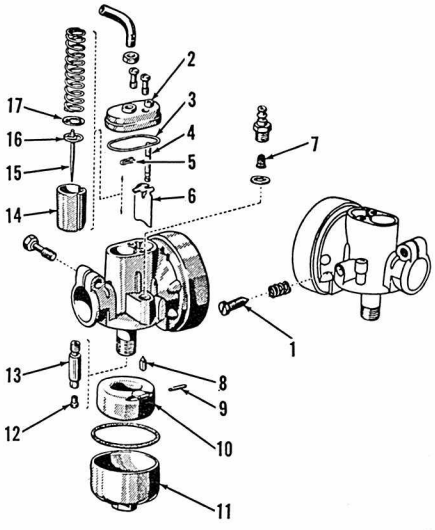


Fig. A1-2—Exploded view of Bing 1/17 carburetor.

1. Idle speed adjusting screw
4. Choke thrust pin
5. Clip
6. Choke slide
7. Fuel strainer
8. Float needle valve
10. Float
11. Cover
12. Main jet
13. Needle jet
14. Throttle slide
15. Needle valve
16. Clip
17. Washer

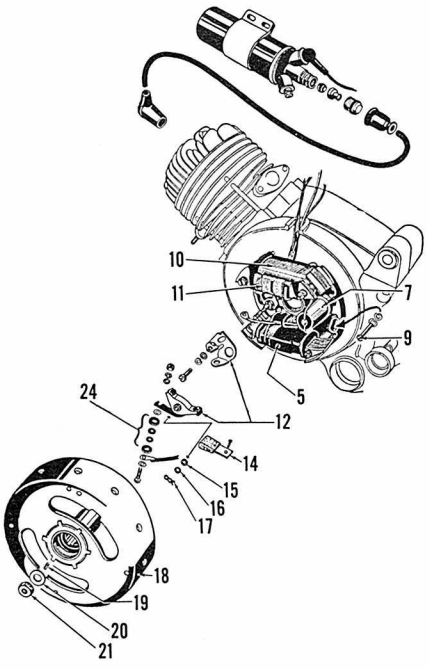


Fig. A1-3—View of the flywheel electrical system typical of all models. On some early models, ignition coil may be at 10 instead of location 5.

(16) should be installed in third groove from top of needle (15). Make certain washer (17) is installed. Idle speed screw (1) is on right side.

IGNITION AND ELECTRICAL. A flywheel type magneto is used and consists of three systems. The ignition primary coil (5—Fig. A1-3), head and tail light coil (10), stop light coil (11) and ignition points (12) are located on left side of engine under the flywheel (18). Ignition points should be set to 0.4 MM (0.016 in.) fully open. With ignition point gap correctly set, ignition timing should occur with piston 1.8 MM (0.07087 in.) BTDC on 50cc models; 1.0 MM (0.03937 in.) on Sport 60 and Cheyenne and 1.1 MM (0.04331 in.) on Motor Scooter. If timing is incorrect, the coil stator plate

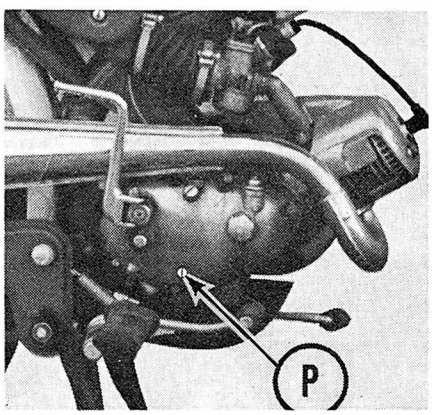


Fig. A1-5—Gear box oil should be maintained at level of plug (P). All models are similar.

1. Snap ring
3. Cap
4. Rubber washer
5. Return spring
6. Rubber washer
7. Clutch shaft
10. Gasket
12. Ball nut
13. Snap ring
14A. Bearing shell
14B. Set bolt
14C. Snap ring
15. Nut
16. Lock washer
17. Spring cup
18. Clutch spring
19. Spring cage
20. Steel clutch disc
21. Clutch friction plates
22. Clutch hub
23. Thrust washer
24. Clutch housing
25. Bushing
26. Thrust washer

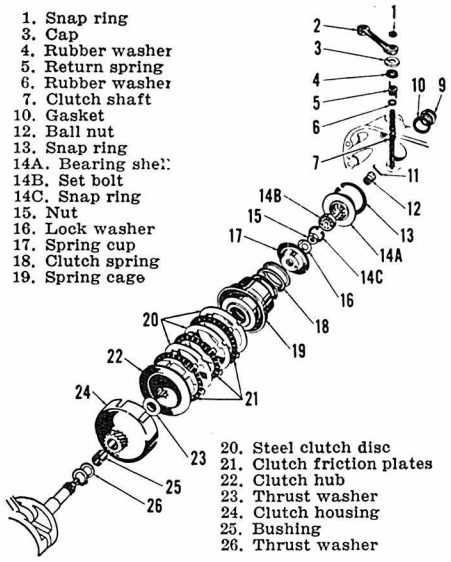


Fig. A1-6—Exploded view of clutch used on all models except Mo-Ped 50. Mo-Ped 50cc model is similar.

can be moved in the elongated holes after loosening the three mounting screws (9).

LUBRICATION. Engine is lubricated by mixing SAE50 two stroke motor oil with the fuel. Normal ratio is 1:25. The gear box is lubricated with SAE40 or 50 oil (in cold weather use SAE 20 or 30). Gear box oil should be maintained at oil level plug (P—Fig. A1-5). Oil should be drained every 4000 miles.

CLUTCH. The clutch, located on right side of engine, is of the multiple disc, wet type. The clutch lever (2—Fig. A1-6) should not have less than 10 MM (0.3937 in.) free play with cable disconnected. If adjustment is required, remove plug (9) and lock wire (11). Turn ball nut (12) as required and install lock wire. Adjustment of the cable will take up excessive play in controls.

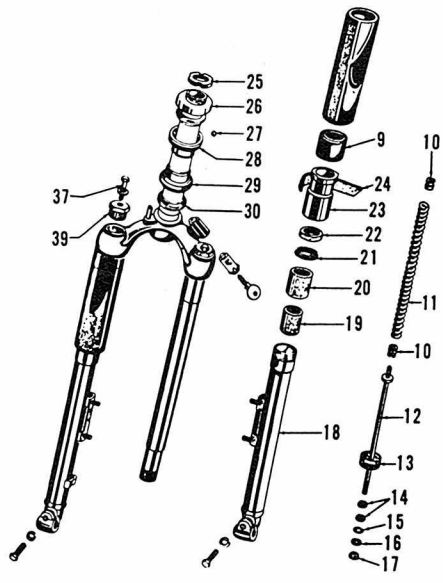


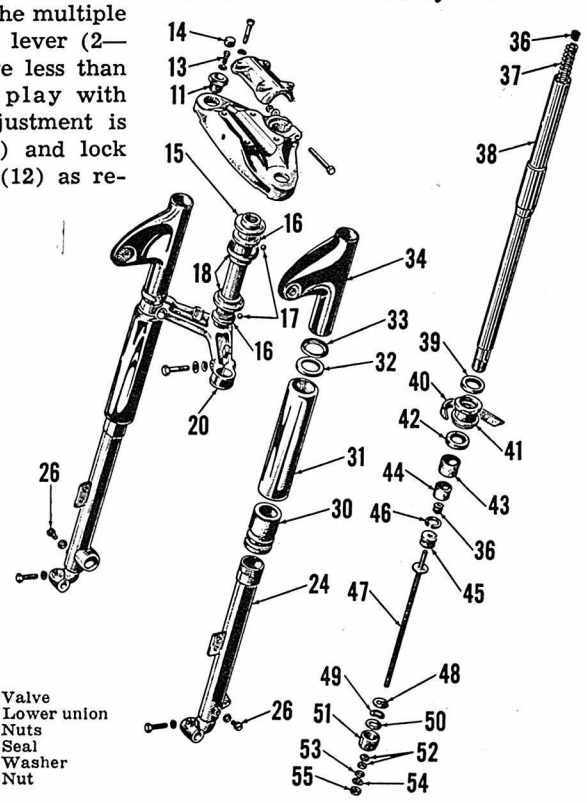
Fig. A1-7—Exploded view of Mo-Ped and Campus 50 front suspension assembly.

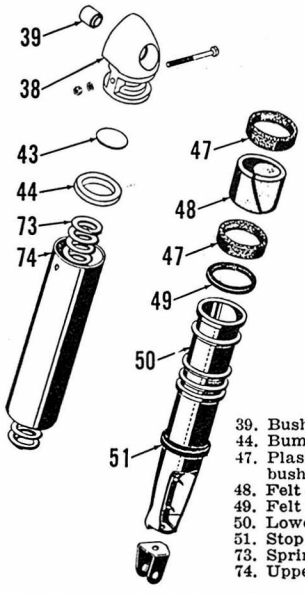
9. Bumper
10. Couplings
11. Spring
12. Spring bolt
13. Bottom joint
14. Nuts
15. Sealing Washer
16. Washer
17. Nut
18. Sliding tube
19. Bottom guide
20. Top guide bushing
21. Seal
22. Felt washer
23. Sealer shell
24. Felt strip
25. Nut
26. Dust cap
27. Bearing balls (42 used)
28. Bearing seat
29. Bearing seat
30. Bearing cones

SUSPENSION. The front fork on Mo-Ped and Campus 50 is shown in Fig. A1-7. Oil in the telescopic fork should be drained every 6000 miles.

Fig. A1-8—Exploded view of Sport 60, Saber and Cheyenne front suspension assembly.

11. Plug
13. Screw
14. Plug
15. Dust cover
16. Bearing cones
17. Bearing balls (42 used)
18. Bearing cups
20. Fork bridge
24. Sliding tube
30. Bumper
31. Cover
32. Rubber spacer
33. Centering ring
34. Headlight bracket
36. Couplings
37. Spring
38. Inner fork tube
39. Felt washer
40. Felt scraper ring
41. Sealer shell
42. Rubber collar
43. Upper bushing
44. Lower bushing
45. Piston
46. Piston ring
47. Spring bolt
48. Washer
49. Spring washer
50. Valve
51. Lower union
52. Nuts
53. Seal
54. Washer
55. Nut





39. Bushing
44. Bumper
47. Plastic guide bushings
48. Felt
49. Felt washer
50. Lower sliding tube
51. Stop ring
73. Spring
74. Upper sliding tube

Fig. A1-9 — Exploded view of suspension unit typical of type used on rear of Mo-Ped and Campus 50 and both front and rear of 60cc Motor Scooter.

Service with oil at screw (37). Capacity is 40cc for each side.

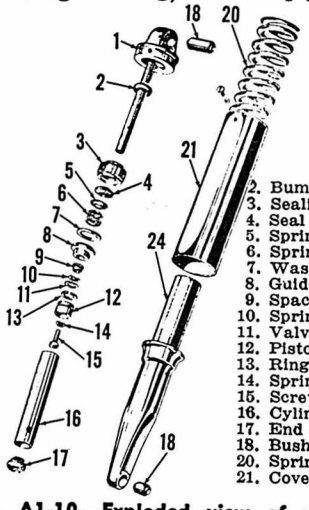
Sport 60, Saber and Cheyenne telescopic front forks should be drained and refilled with SAE 30 or 40 motor oil every 3700 to 5000 miles. Oil is drained and refilled at plug (26—Fig. A1-8). Capacity for each side is 100cc.

Suspension units for Motor Scooters and rear units for Mo-Ped and Campus 50 is shown in Fig. A1-9.

Rear suspension units on Sport 60, Saber and Cheyenne should be drained and refilled with shock absorber fluid every 3700 to 5000 miles. Capacity is 65cc for each unit. The units must be removed and 22 MM nut (3—Fig. A-1-10) loosened before servicing cylinder.

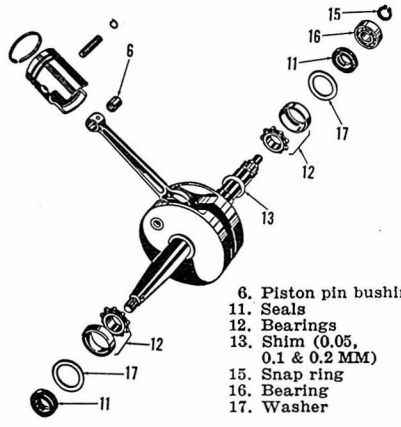
REPAIRS

PISTON, RINGS AND CYLINDER. The piston can be removed after first removing cowling, exhaust pipe, carburetor, cylinder head and cylinder. Ring end gap should be 0.1-0.8 MM (0.00394-0.03150 inch). Piston should have 0.12-0.15 MM (0.0047-0.0059 inch) clearance in cylinder bore. Standard cylinder bore diameter is 38 MM (1.4961 in.) for 50cc models, 42 MM (1.6535 in.) for 60cc models. Piston and rings are available in standard size and 0.5 MM oversize. Piston should be installed with both ring groove pins toward front of en-



2. Bumper
3. Sealing screw
4. Seal
5. Spring cup
6. Spring
7. Washer
8. Guide bushing
9. Spacer
10. Spring washer
11. Valve
12. Piston
13. Ring
14. Spring washer
15. Screw
16. Cylinder
17. End cap
18. Bushing
20. Spring
21. Cover

Fig. A1-10—Exploded view of rear suspension unit typical of Sport 60, Saber and Cheyenne.



6. Piston pin bushing
11. Seals
12. Bearings
13. Shim (0.05, 0.1 & 0.2 MM)
15. Snap ring
16. Bearing
17. Washer

Fig. A1-12—Crankshaft, bearings and piston typical of all models. Crankshaft and connecting rod are available only as a complete unit.

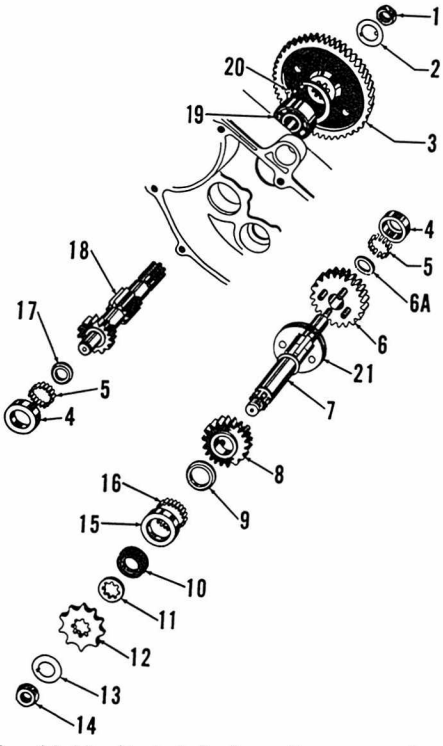
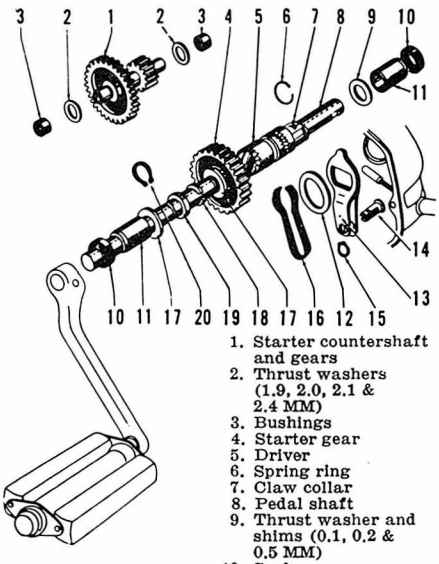


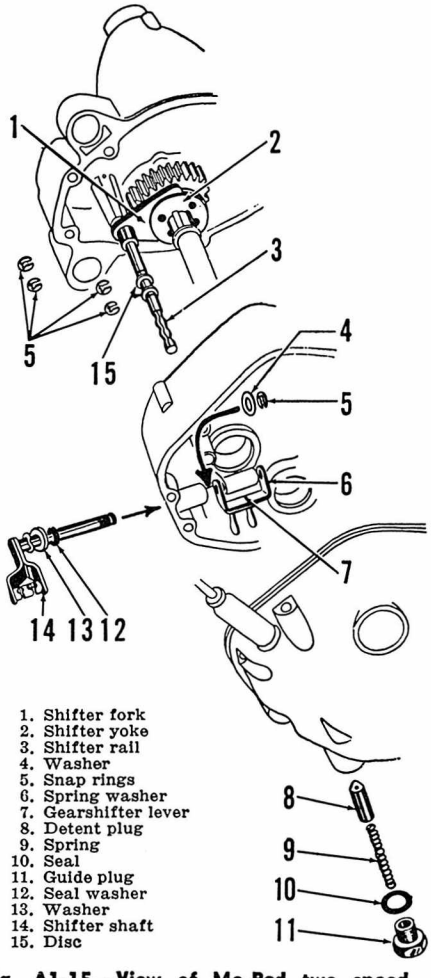
Fig. A1-13—Exploded view of two speed transmission.

1. Nut
2. Lock plate
3. Driven gear
4. Bearing race
5. Bearing rollers (14 for each race)
6. First speed gear
6A. Spacer (1.6, 1.8, 2.0 & 2.5 MM)
7. Output shaft
8. Second speed gear
9. Thrust washer
10. Seal
11. Spacer
12. Sprocket
13. Lock plate
14. Nut
15. Bearing race
16. Bearing rollers (18 used)
17. Thrust washer
18. Input shaft
19. Bearing
20. Snap ring
21. Gearshift yoke



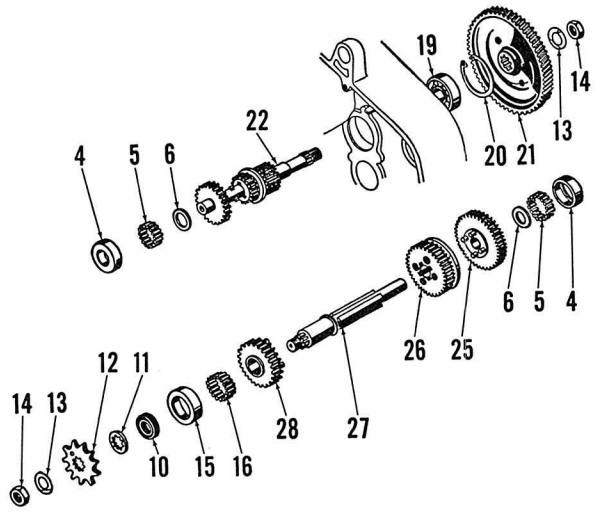
1. Starter countershaft and gears
2. Thrust washers (1.9, 2.0, 2.1 & 2.4 MM)
3. Bushings
4. Starter gear
5. Driver
6. Spring ring
7. Claw collar
8. Pedal shaft
9. Thrust washer and shims (0.1, 0.2 & 0.5 MM)
10. Seals
11. Bushings
12. Washer
13. Brake lever
14. Clevis
15. Snap ring
16. Driver brake spring
17. Thrust washer
18. Snap ring
19. Catch ring
20. Snap ring

Fig. A1-14 — View of Mo-Ped starting and pedaling assembly.



1. Shifter fork
2. Shifter yoke
3. Shifter rail
4. Washer
5. Snap rings
6. Spring washer
7. Gearshifter lever
8. Detent plug
9. Spring
10. Seal
11. Guide plug
12. Seal washer
13. Washer
14. Shifter shaft
15. Disc

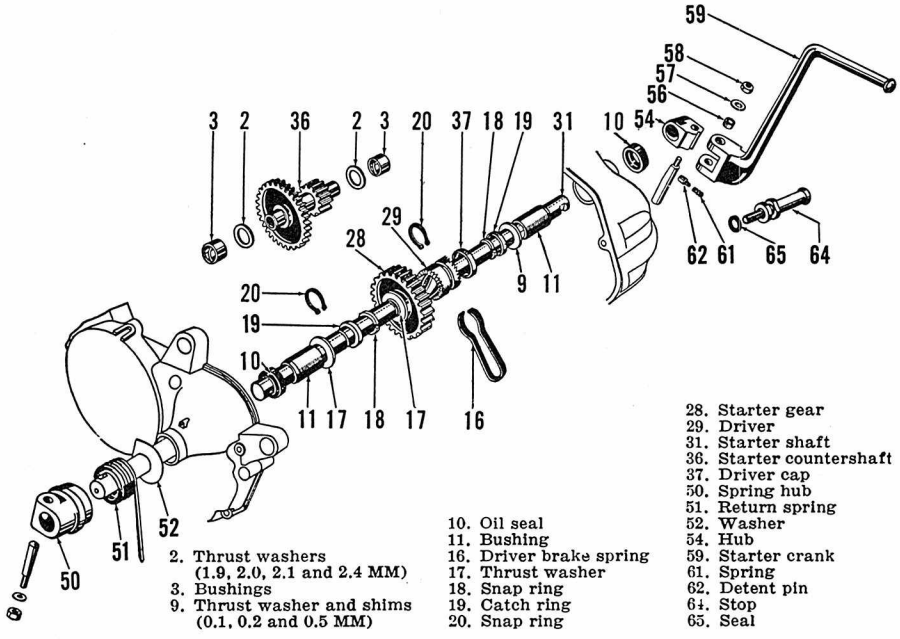
Fig. A1-15—View of Mo-Ped two speed gear shift mechanism.



4. Bearing races
5. Bearing rollers (14 for each race)
6. Shims (1.6, 1.8, 2.0 & 2.5 MM)
10. Oil seal
11. Spacer
12. Sprocket
13. Lock plates
14. Nuts
15. Bearing race
16. Bearing rollers (18 used)
19. Bearing
20. Snap ring
21. Driven gear
22. Input shaft and gears
25. First speed gear
26. Second speed gear
27. Output shaft
28. Third speed gear

Fig. A1-16—Exploded view of typical three speed transmission.

CRANKCASE AND GEAR BOX. To disassemble the crankcase and gear box, the engine must first be removed. Remove the cowling, cylinder head, cylinder, piston, flywheel, clutch cover and clutch. Remove the blower baseplate and gear shift assembly (Fig. A1-18). Remove screws that attach crankcase halves together and carefully separate the halves. Dowel pins are installed between halves. Be careful not to damage sealing surfaces of crankcase. The transmission gears are shown in Figs. A1-13 and A1-16.



2. Thrust washers (1.9, 2.0, 2.1 and 2.4 MM)
3. Bushings
9. Thrust washer and shims (0.1, 0.2 and 0.5 MM)
10. Oil seal
11. Bushing
16. Driver brake spring
17. Thrust washer
18. Snap ring
19. Catch ring
20. Snap ring
28. Starter gear
29. Driver
31. Starter shaft
36. Starter countershaft
37. Driver cap
50. Spring hub
51. Return spring
52. Washer
54. Hub
59. Starter crank
61. Spring
62. Detent pin
64. Stop
65. Seal

Fig. A1-17—View of starter assembly typical of all models except Mo-Ped.

gine. Piston pin is full floating type and is held in place with snap rings Fins on cylinder head should run from side to side.

CONNECTING ROD AND CRANKSHAFT. The crankshaft is supported in three ball type main bearings. Bearings and/or crankshaft can be removed after disassembling crankcase as outlined in CRANKCASE AND GEAR BOX. The connecting rod and crankshaft are available only as a complete unit and should **NOT** be disassembled. Crankshaft end play is adjusted to 0.0 (DO NOT PRELOAD BEARINGS) by adding shims (13—Fig. A1-12).

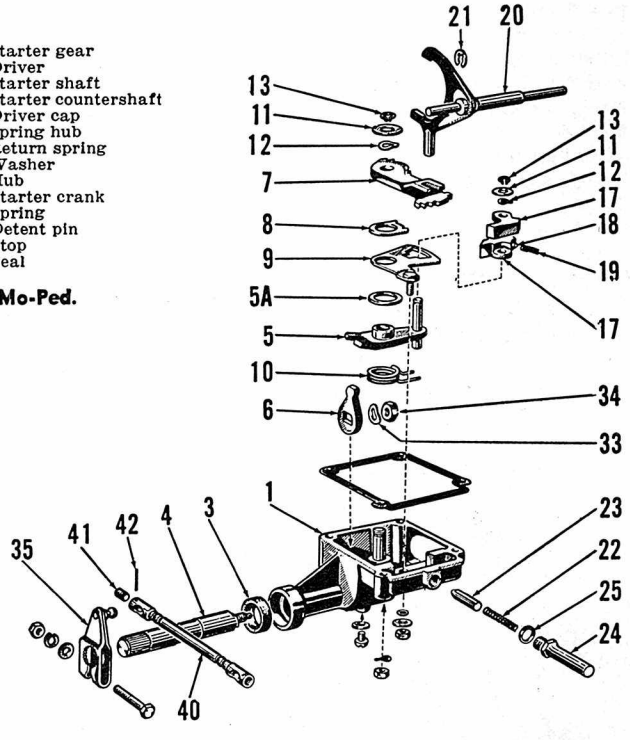


Fig. A1-18—Exploded view of shifter mechanism used on three speed transmissions.

1. Housing
3. Oil seal
4. Selector shaft
5. Gearshift lever
5A. Thrust washer
6. Lever
7. Ratchet
8. Lifting plate
9. Support plate
10. Selector spring
11. Washer
12. Spring washer
13. Snap-ring
17. Shifter dog
18. Pin
19. Spring
20. Shift fork
21. Snap ring
22. Spring
23. Detent
24. Guide plug
25. Seal
35. Exterior shift lever
40. Control rod

ALLSTATE 125CC MOTOR SCOOTER

Allstate 125cc Motor Scooters manufactured by Piaggio & C.-S. p. A. are similar to Vespa models as listed below. Refer to appropriate Vespa section for repairs.

Frame No. Prefix	Engine No. Prefix	Vespa Model Prefix
VA10T	VNA2M	VNB1T
VA11T	VNB1M	VNB2T
VA12T	VNB2M	VNB2T
VA13T	VNB3M	VNB3T
VA14T	VNB4M	VNB4T

ALLSTATE 150

MODEL	ALLSTATE, SEARS 150
Displacement-cc	121.07
Bore-MM	52
Stroke-MM	57
Number of cylinders	1
Oil-fuel ratio	1 to 24
Plug gap—inch	0.020-0.025
Point gap—inch	0.016
Ignition timing-advance	Fixed
Inches BTDC	0.177
Electrical system voltage	6
Tire size	2.75 x 16
Tire pressure psi—front	20
Rear	*25-26
Chain free play—inch	⅞
Number of speeds	3
Weight Lbs. (approx.)	158

*30 psi with two riders

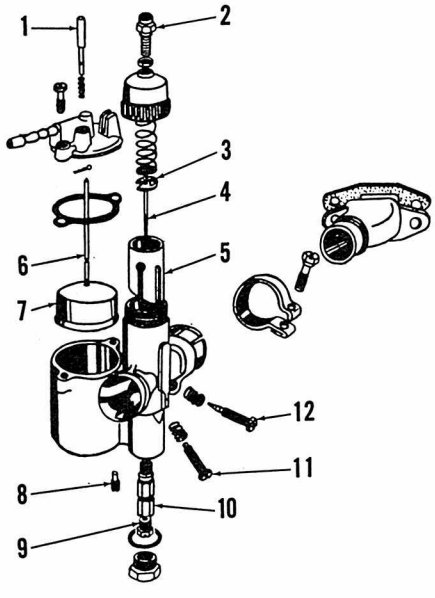


Fig. A2-1—Exploded view of Fisher-Amal carburetor.

1. Primer
2. Cable adjuster
3. Clip
4. Valve needle
5. Throttle slide
6. Fuel inlet needle
7. Float
8. Idle jet
9. Main jet
10. Needle jet
11. Idle speed screw
12. Idle mixture needle

MAINTENANCE

SPARK PLUG. Electrode gap should be 0.020-0.025 inch. Recommended spark plug is Allstate 60410. Champion L-10 can be used.

CARBURETOR. Fisher-Amal 19EIK carburetor is shown in Fig. A2-1. Main jet (9) standard size is 90. Needle valve clip (3) should be installed in third groove from top of needle (4). Idle speed is adjusted at screw (11) and idle mixture at needle (12). Initial setting for mixture needle (12) is 1-1½ turns open. Turning the needle counter-clockwise leans the mixture.

IGNITION AND ELECTRICAL. A flywheel type magneto is used as shown in Fig. A 2-2. Electrical current for stop light is provided by coil (6) and current for other lights and horn is provided by coils (3 & 5).

Ignition breaker point gap should be 0.016 inch and points should just open when piston is 0.177 inch BTDC. If ignition timing is incorrect, the coil stator plate can be moved in the elongated holes after removing the flywheel and loosening the three stator mounting screws.

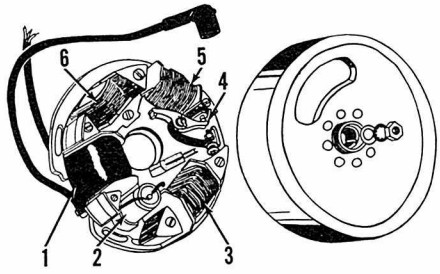


Fig. A2-2—View of flywheel magnetos.

1. Ignition coil
2. Condenser
3. Lighting coil
4. Breaker points
5. Lighting coil
6. Stop light coil

LUBRICATION. The engine is lubricated by mixing SAE 40 two stroke motor oil with the fuel. Oil to gasoline ratio should be 1:16 for the first 200 miles and 1:24 after the break-in period. The gear box is lubricated by approximately 0.9 pint of SAE 40 (SAE 30 in winter) motor oil. Oil should be maintained at $\frac{7}{16}$-inch below the clutch adjustment hole in the right side cover (Fig. A 2-3). Oil should be drained, flushed and filled with new oil after the first 600 miles and then every 7,500 miles.

CLUTCH. The clutch, located on the right end of the transmission input shaft, is of multiple disc wet type. Adjustment is accomplished after removing small cover as shown in Fig. A2-3. The center adjusting screw (S) should be adjusted to provide 0.08-0.12 inch free play at end of lever (L). The clutch cable should be adjusted to just take up excessive play in controls without causing any pre-load. The clutch spring adjusting nuts can also be adjusted. Make certain that all are adjusted evenly.

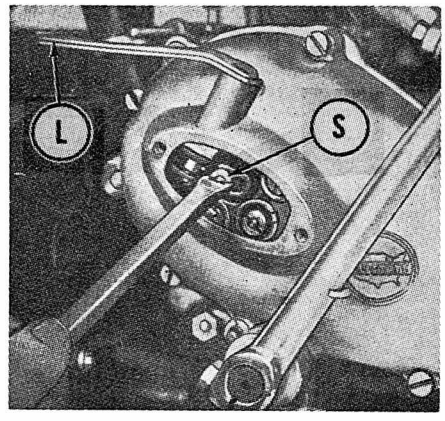


Fig. A2-3—Clutch is adjusted at screw (S). Refer to text.

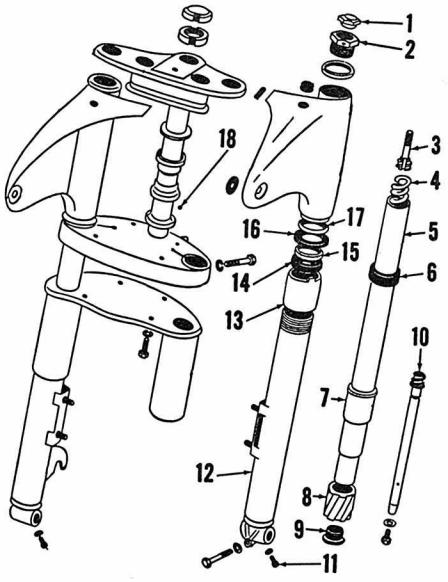


Fig. A2-4—Exploded view of front fork and suspension.

1. Filler plug
2. Retaining nut
3. Top spring retainer
4. Spring
5. Tube
6. Bumper ring
7. Bushing
8. Bushing
9. Plug
10. Spring support
11. Drain screw
12. Sliding tube
13. Retainer nut
14. Seal
15. Felt washer
16. Rubber washer
17. Centering ring
18. Ball bearing (42 used)

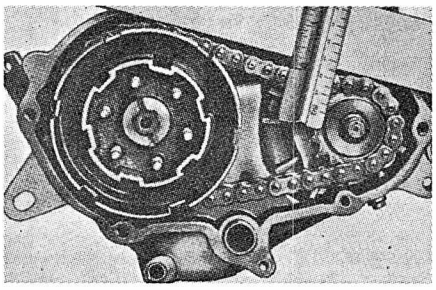


Fig. A2-5—Primary chain tension is not adjustable. Renew chain if slack exceeds 0.4 inch.

SUSPENSION. The front fork is shown in Fig. A2-4. Oil should be drained every 3,000-4,000 miles and refilled with SAE 40 motor oil (SAE 20 or 30 in winter). Each unit should contains 8cc (2⅓ fl. oz.) of oil.

REPAIRS

PISTON, RINGS AND CYLINDER. The piston can be removed after first removing cowling, exhaust pipe, carburetor, cylinder head and cylinder. Ring end gap should be within limits of 0.004-0.032 inch. Ring side clearance in groove should be 0.004-0.006 inch. Standard cylinder bore nominal diameter is 52MM (2.0472 in.). Piston

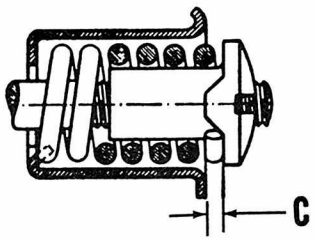
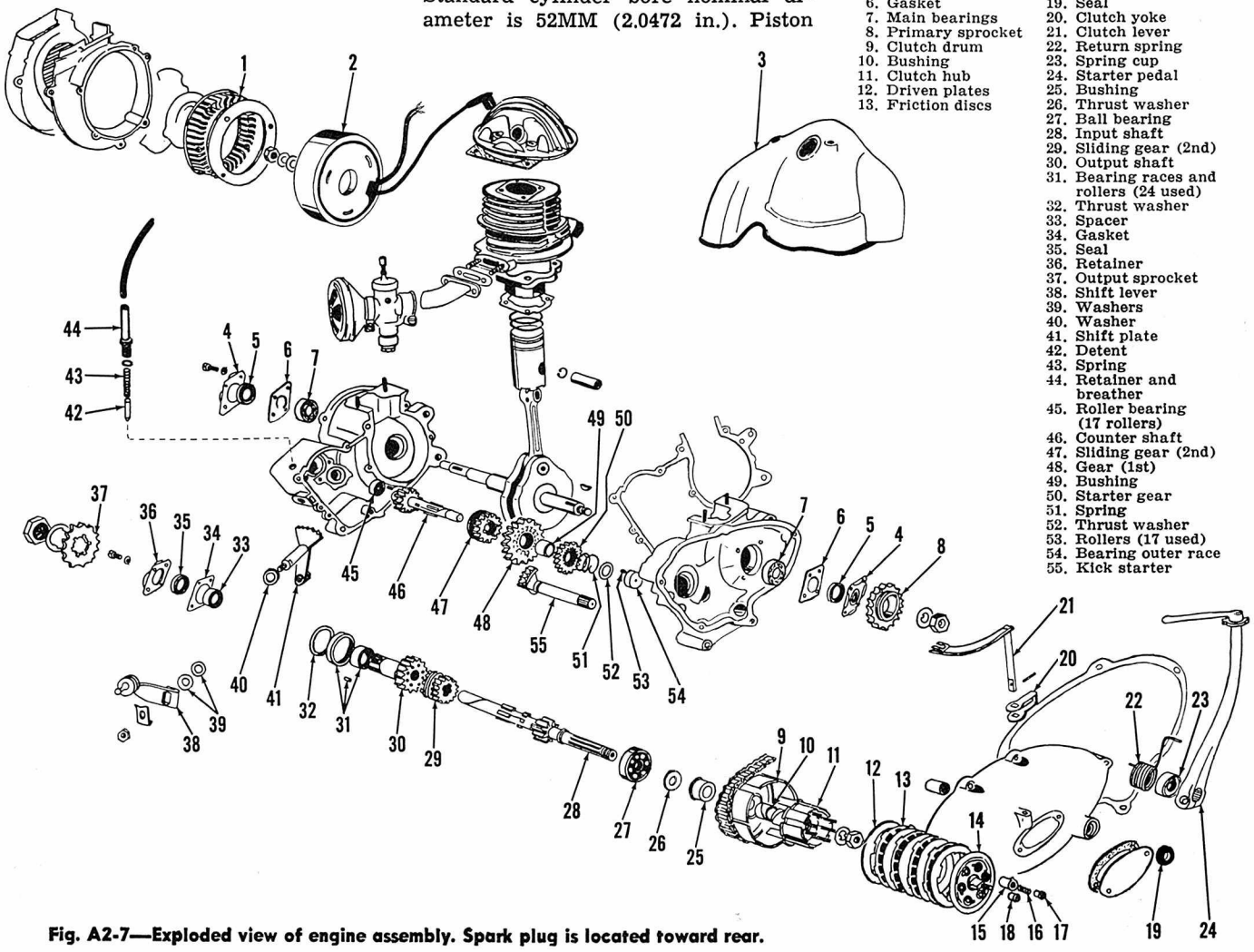


Fig. A2-6—Clearance (C) should be more than 0.06 inch. If clutch slips when adjusted to minimum clearance, renew plates as necessary.

and rings are available in standard size and oversizes of 52.5MM and 53MM.

When installing piston, cut-away side should be toward rear (carburetor) and sides (transfer ports). Make certain that ends of rings engage the pins in grooves.

CONNECTING ROD AND CRANKSHAFT. To remove the crankshaft and connecting rod, the crankcase halves must be separated. The connecting rod, crankpin bearing and crankshaft are available only as a complete unit



1. Fan
2. Magneto
3. Top cowling
4. Retainer
5. Seal
6. Gasket
7. Main bearings
8. Primary sprocket
9. Clutch drum
10. Bushing
11. Clutch hub
12. Driven plates
13. Friction discs
14. Pressure plate
15. Spring cup
16. Spring
17. Nut
18. Adjusting nut
19. Seal
20. Clutch yoke
21. Clutch lever
22. Return spring
23. Spring cup
24. Starter pedal
25. Bushing
26. Thrust washer
27. Ball bearing
28. Input shaft
29. Sliding gear (2nd)
30. Output shaft
31. Bearing races and rollers (24 used)
32. Thrust washer
33. Spacer
34. Gasket
35. Seal
36. Retainer
37. Output sprocket
38. Shift lever
39. Washers
40. Washer
41. Shift plate
42. Detent
43. Spring
44. Retainer and breather
45. Roller bearing (17 rollers)
46. Counter shaft
47. Sliding gear (2nd)
48. Gear (1st)
49. Bushing
50. Starter gear
51. Spring
52. Thrust washer
53. Rollers (17 used)
54. Bearing outer race
55. Kick starter

Fig. A2-7—Exploded view of engine assembly. Spark plug is located toward rear.

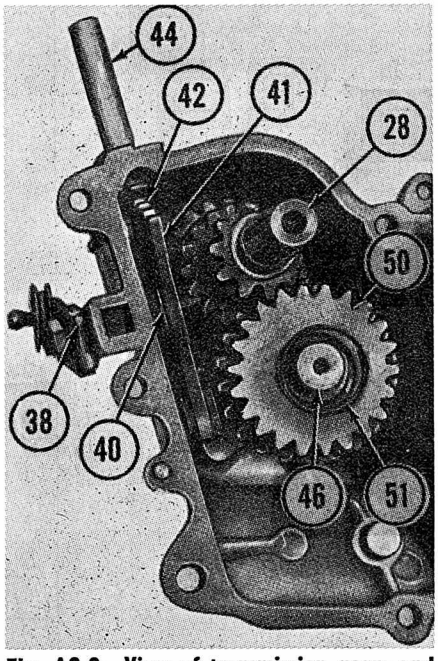


Fig. A2-8—View of transmission gears and shafts installed. Refer to Fig. A2-7 for legend.

and should **NOT** be disassembled. Crankshaft end play should be adjusted to 0.2MM (0.008 in.) by adding shims between main bearing inner races and crankshaft flywheels. DO NOT PRELOAD BEARINGS.

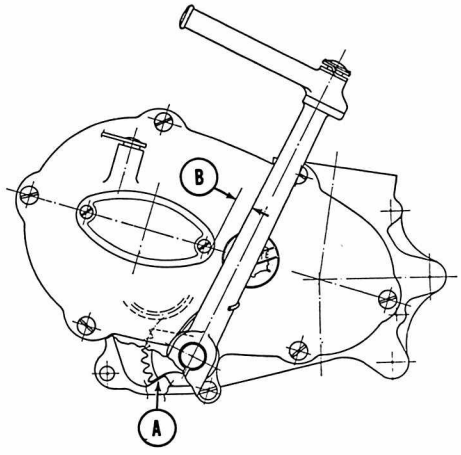


Fig. A2-9—Refer to text when installing the kick starter pedal.

CLUTCH. Refer to Fig. A2-7 for exploded view of clutch assembly. Renew friction discs and/or steel plates (12 & 13) which show any evidence of wear, overheating or damage. Primary drive chain tension is not adjustable. Primary chain and (if necessary) sprockets should be renewed if chain slack is more than 0.4 inch (Fig. A2-5). When installing clutch plates, install thick (2MM) steel plate in clutch drum, then one friction disc (13—Fig. A2-7). Alternate regular steel plates and friction discs. The last (outside) steel plate has the internal drive lugs bent in (toward the gear case). When adjusting the clutch spring nuts (17), tighten all nuts evenly until clutch does not slip. Springs can be adjusted through the small cover on right side cover after unit is assembled. Minimum clearance between adjuster nuts (17) and spring cups (15) is 0.06 inch as shown at (C—Fig. A2-6).

CRANKCASE AND GEAR BOX. To disassemble the crankcase and gear box, the engine must first be removed. Remove the cowling, cylinder head, cylinder, piston, flywheel, clutch and crankshaft gear. Remove screws that attach crankcase halves together and carefully separate the halves. Dowel pins are installed between halves. Be careful not to damage sealing surfaces of crankcase. The transmission is shown in Fig. A2-7.

Use light grease to hold the 17 loose rollers in the bearing cages (45 & 54) when assembling. Before installing the kick starter pedal (24), turn the starter shaft counter-clockwise until gear contacts case as shown at (A—Fig. A2-9). Install starter lever on shaft so that distance (B) between lever and front of screw is ¼-½ inch, then hook return spring over lever.

ALLSTATE 175 AND 250CC

MODEL	175	250
Displacement—cc	172	248
Bore—MM	42	45
Stroke—MM	62	78
Number of cylinders*	2	2
Oil-Fuel ratio	1 to 24	oil pump
Plug gap—inch	0.020-0.025	0.024-0.028
Point gap—inch	0.016	0.016
Ignition timing—Advance	Fixed	Fixed
Inch BTDC	0.216	0.266
Electrical system voltage	6	6
Battery terminal grounded	Negative	Negative
Tire size	3.25 x 16	3.50 x 16
Tire pressure psi-front	20	14.5
Rear**	25	20
Chain free play-inch	25/32	25/32
Number of speeds	4	4
Weight—Lbs. (Approx.)	247	309

*One combustion chamber
**Increase rear tire pressure to 28 psi on 175cc models; 29 psi on 250cc models when carrying passengers

MAINTENANCE

SPARK PLUG. One spark plug is used on 175cc models, two spark plugs are used on 250cc models. Allstate 60400 or Champion L10 spark plugs should be used for all models. Electrode gap should be 0.020-0.025 inch for 175cc models, 0.024-0.028 inch for 250cc models.

CARBURETOR. Fisher-Amal 24 E 1 A carburetor (Fig. A3-1) is used on 175cc models. Puch P32/1 carburetor (Fig. A3-2) is used on 250cc models. Refer to the following for carburetor normal settings.

175cc

Refer to Fig. A3-1

Main jet (9)	150
Idle jet (8)	0.0138-0.014 in.
Needle jet (10)	2.8

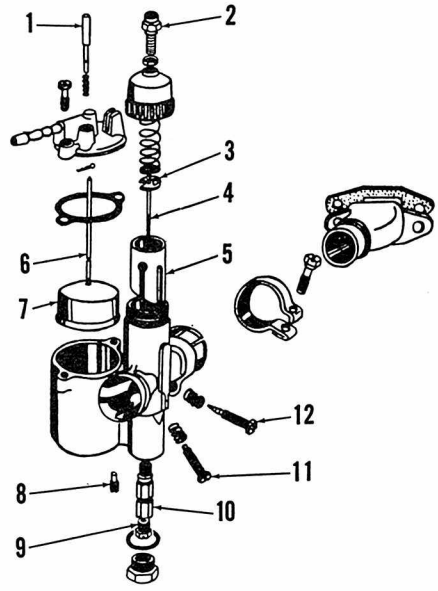


Fig. A3-1—Exploded view of Fisher-Amal carburetor used on 175cc models.

1. Primer
2. Cable adjuster
3. Clip
4. Valve needle
5. Throttle slide
6. Fuel inlet needle
7. Float
8. Idle jet
9. Main jet
10. Needle jet
11. Idle speed screw
12. Idle mixture needle

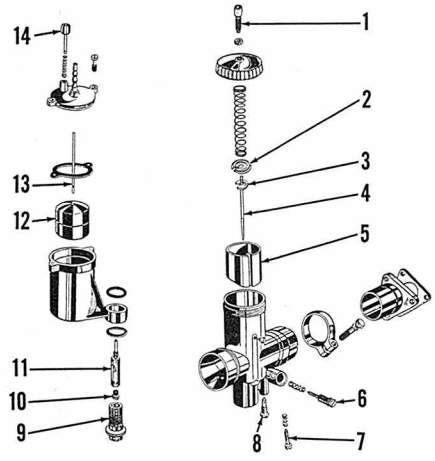


Fig. A3-2—Exploded view of Puch carburetor used on 250cc models.

1. Cable adjuster
2. Clip cover
3. Clip
4. Valve needle
5. Throttle slide
6. Idle mixture needle
7. Idle speed screw
8. Idle jet
9. Float screw
10. Main jet
11. Needle valve
12. Float
13. Fuel inlet valve
14. Primer

Clip (3) should be in third groove from top of needle (4). Inital setting for idle mixture needle (12) is ½-1 turn open.

250cc

Refer to Fig. A3-2

Main jet (10)—summer 145
Winter 140
Idle jet (8) 35

Clip (3) should be in fourth groove from top of needle (4). Initial setting for idle mixture needle (6) is ½-1 turn open.

On all models, turning the idle mixture needle (12—Fig. A3-1 or 6—A3-2) counter-clockwise leans the mixture.

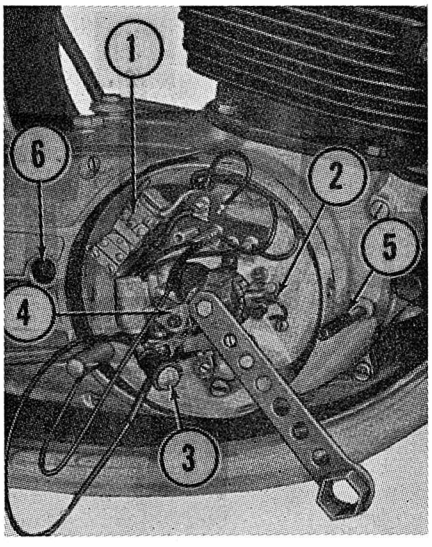


Fig. A3-3—View of right side with cover removed. Refer to text for adjusting the ignition timing.

1. Voltage regulator
2. Generator brushes
3. Light (used for timing)
4. Breaker points
5. Timing pin
6. Clutch adjusting screw

IGNITION AND ELECTRICAL. All models are equipped with battery ignition system. The generator armature is mounted on the right end of the crankshaft and voltage is controlled by regulator mounted on the stator plate. Ignition breaker point gap should be 0.016 inch. Ignition timing should occur (breaker points just open) when the rear piston is 0.216 inch BTDC on 175cc models; 0.266 inch BTDC on 250cc models. The piston can be correctly positioned by inserting 6MM (15/64-inch) diameter rod through hole in crankcase and into hole in crankshaft as shown at (5—Fig. A3-3). If timing is incorrect, loosen the armature retaining screw and move the armature (and breaker cam) on the crankshaft as necessary.

The voltage regulator (1) should be adjusted to 7.5-7.7 volts with engine running at 2000 rpm. Voltage adjusting screw on regulator is marked with red paint.

LUBRICATION. The engine on 175cc models is lubricated by mixing SAE 40 or 50, two-stroke oil with the gasoline. Oil to fuel ratio should be 1:16 for the first 200 miles; 1:24 after the break-in period.

The engine used on 250cc models is equipped with a separate oil tank and oil pump. The pump varies the amount of oil delivered to the engine for proper lubrication. For the first 1250 miles, oil should be mixed with the fuel in addition to the oil delivered by the pump. Oil to gasoline ratio should be 1:50 during break-in. Oil mixed with the fuel (during break-in) and in the separate oil tank should be SAE 40 or 50 (SAE 30 in winter) two-stroke motor oil.

To adjust the oil pump metering system, remove the small cover (1—Fig. A3-4). Twist throttle grip to full open and check to make certain that carburetor throttle slide is completely up. When the carburetor throttle slide is completely open, the white mark on pump lever should be aligned with the red mark on crankcase as shown at (2). Adjustment is accomplished at cable adjuster (3). It may be necessary to adjust throttle cable if slide is not completely open. Oil consumption should be approximately 1 pint every 150-175 miles.

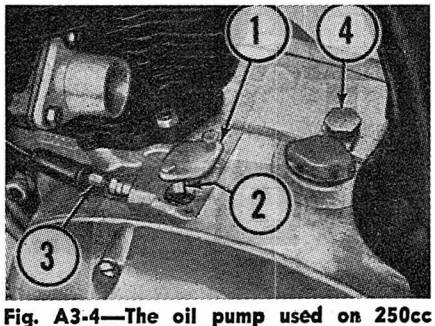


Fig. A3-4—The oil pump used on 250cc models must be adjusted as described in text.

1. Cover 2. Adjusting marks 3. Cable adjuster

To remove the engine lubricating pump, it is necessary to first remove the clutch. When reinstalling, turn the gear on pump until plunger is at top of stroke and mount pump assembly. The pump should be positioned so that backlash between worm gear teeth and pump gear teeth is 0.005-0.007 inch when the pump gear is at top of stroke. After installation, make certain that pump operates freely. The pump is available as an assembly.

On all models, the clutch and transmission is lubricated by 1½ pints of SAE 40 (SAE 30 in winter) motor oil contained in the gear case. Oil should be drained and flushed after the first 600 miles and every 8,000 miles. Oil level should be maintained between marks on filler plug dipstick on 175cc models, or at level of plug (P—Fig. A3-5) on 250cc models.

CLUTCH. The clutch should have less than ½-inch free play as measured at end of hand lever. If free play is excessive, adjust the cable. If adjustment can not be accomplished at cable adjusters on 250cc models, additional adjustment is available at screw (6—Fig. A3-3). Lock plate on screw (6) prevents fine adjustment and screw must be turned at least ⅛-turn. Final adjustment should be accomplished at cable.

SUSPENSION. The front fork is shown in Fig. A3-6. Oil should be drained from plug (D) every 4,000 miles. Refill at upper plug (F) with

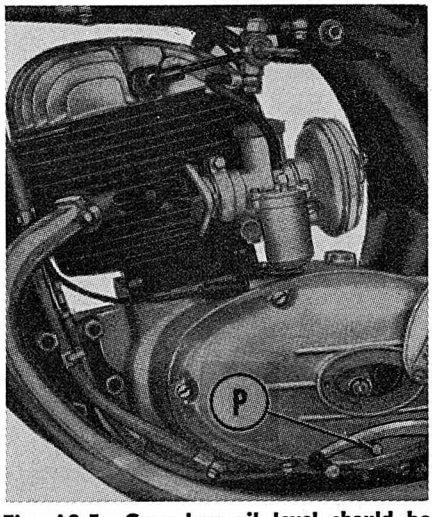


Fig. A3-5—Gear box oil level should be maintained at level of plug hole (P) on 250cc models.

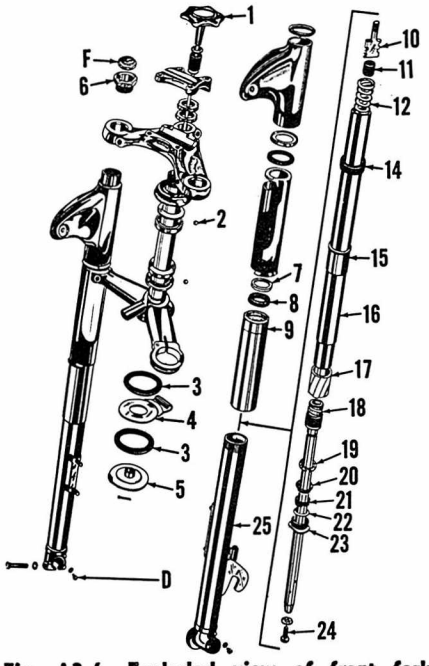


Fig. A3-6—Exploded view of front fork typical of all 175 and 250cc models.

D. Drain plug
F. Filler plug
1. Friction knob
2. Bearing balls (36 used)
3. Friction discs
4. Friction (damper) arm
5. Pressure plate
6. Top plug
7. Felt washer
8. Rubber washer
9. Union nut
10. Spring retainer
11. Rubber plug
12. Spring
14. Rubber (bumper) ring
15. Bushing
16. Tube
17. Bushing
18. Spring support tube
19. Snap ring
20. Valve stop
21. Damper spring
22. Ring valve
23. Bottom joint
24. Screw
25. Lower tube

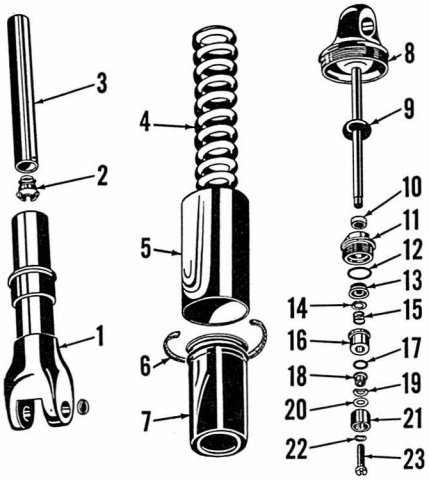


Fig. A3-7—Exploded view of rear suspension unit.

1. Lower strut
2. Bottom bushing
3. Damper cylinder
4. Spring
5. Cover
6. Seal
7. Cover
8. Top strut
9. Bumper
10. Felt ring
11. Nut
12. Rubber ring
13. Ring sleeve
14. Compression washer
15. Spring
16. Guide sleeve
17. Rubber stop ring
18. Spacer
19. Wave washer
20. Ring valve
21. Damper piston
22. Spring washer
23. Nozzle screw

80cc (⅛ pint) of SAE 40 (SAE 30 in winter) motor oil. Bushings (15 & 17) should have less than 0.039 (inch) diametral clearance.

The rear suspension units can be disassembled after unscrewing nut (11—Fig. A3-7). The damper cylinders (3) should contain 71cc of SAE 40 motor oil.

REPAIRS

PISTONS, RINGS AND CYLINDERS. Cylinders and pistons can be removed after engine assembly is removed from frame. Make certain that pistons are marked before removal so that pistons will be installed in same position. Ring side clearance in grooves should not exceed 0.006 inch. Ring end gap should be within limits of 0.004-0.0315 inch. Standard cylinder bore diameter is 42MM (1.65 inch) for 175cc models, 45MM (1.77 inch) for 250cc models. Pistons and rings are available in standard size and two oversizes. When assembling, make certain that ends of rings correctly engage the pins in grooves.

CONNECTING ROD AND CRANKSHAFT. The crankshaft is supported in two ball and one roller type main bearings. Bearings and/or crankshaft can be removed after disassembling crankcase as outlined in CRANKCASE AND GEAR BOX. The connecting rod and crankshaft are available only as a complete unit and should **NOT** be disassembled. Crankshaft end play is adjusted to 0.0 (DO NOT PRELOAD BEARINGS) by adding shims (3—Fig. A3-10).

CRANKCASE AND GEAR BOX. To disassemble the crankcase and gear box, the engine must first be removed. Remove the cylinder head,

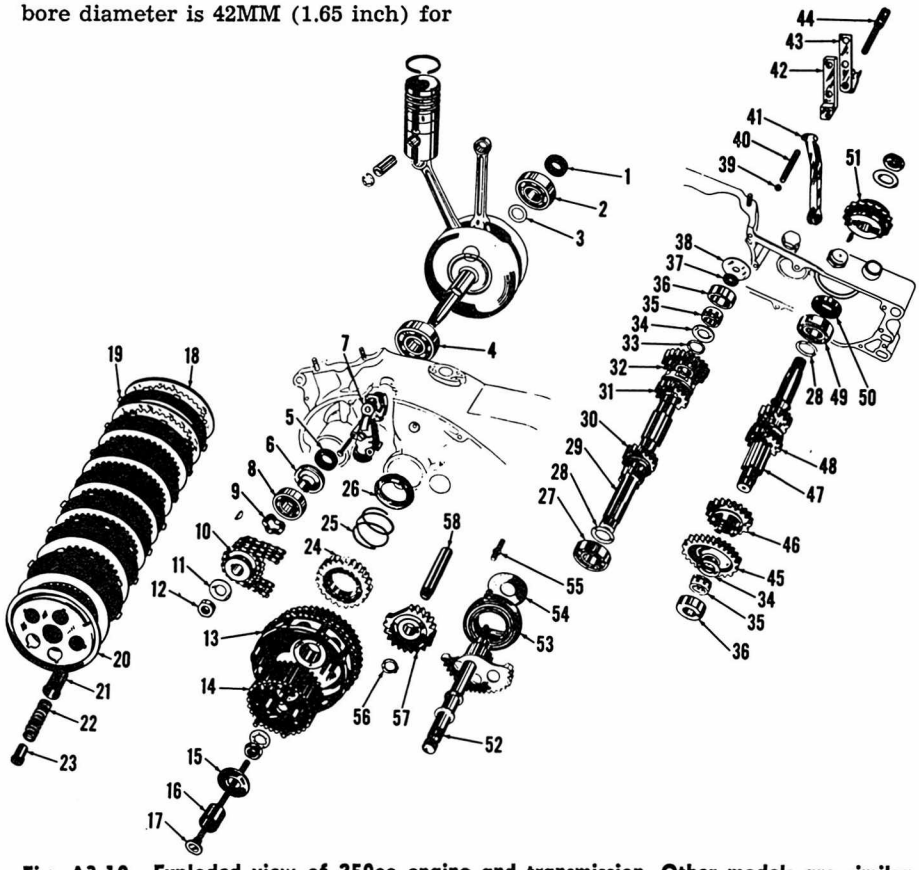


Fig. A3-10—Exploded view of 250cc engine and transmission. Other models are similar. Shift mechanism is shown in Fig. A3-11.

1. Seal
2. Roller bearing
3. Shim
4. Ball bearing
5. Seal
6. Pump drive gear
7. Oil pump
8. Ball bearing
9. Spring washer
10. Sprocket
11. Lock washer
12. Nut
13. Clutch drum
14. Clutch hub
15. Thrust collar
16. Bushing
17. Push rod
18. Driven plate
19. Friction disc
20. Pressure plate
21. Spring cup
22. Spring
23. Adjusting nut
24. Kick starter ratchet gear
25. Spring
26. Spring seat
27. Ball bearing
28. Shim
29. Input shaft
30. Gear (2nd)
31. Gear (3rd)
32. Gear (4th)
33. Shim
34. Thrust washer
35. Roller bearing
36. Outer race
37. Rubber seal washer
38. Plate
39. Ball
40. Clutch release rod
41. Release arm
42. Plate
43. Spring
44. Adjuster screw
45. Gear (1st)
46. Gear (2nd)
47. Output shaft
48. Gear (3rd)
49. Bearing
50. Seal
51. Output sprocket
52. Kickstarter
53. Recoil spring
54. Disc
55. Anchor pin
56. Snap ring
57. Idler gear
58. Idler shaft

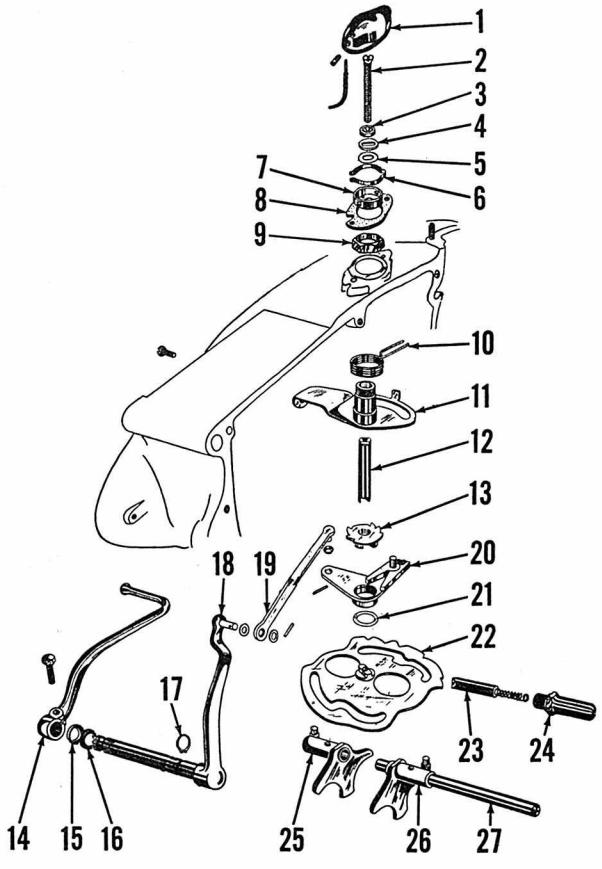


Fig. A3-11—View of gear shift mechanism used on 250cc models. Other models are similar.

1. Switch housing
2. Screw
3. Intermediate disc
4. Disc
5. Shim
6. Contact spring
7. Spring housing
8. Gasket
9. Nut
10. Spring
11. Support plate
12. Guide
13. Ratchet wheel
14. Shift pedal
15. Cup washer
16. Rubber washer
17. Snap ring
18. Inner shift lever
19. Shift rod
20. Shift lever
21. Shim
22. Shift plate
23. Detent & spring
25. Shift fork (1st & 2nd)
26. Shift fork (3rd & 4th)
27. Shift rail

cylinders, pistons, clutch, primary drive chain and primary drive sprocket. Remove the complete generator assembly from right end of crankshaft and the oil pump from left side of crankcase (on 250cc models). Remove screws that attach crankcase halves together and carefully separate the halves. Dowel pins are installed between halves. Be careful not to damage sealing surfaces of crankcase.

When reassembling, check the free play in primary chain. If free play exceeds 0.276 inch, renew the primary chain.

BENELLI

COSMOPOLITAN MOTORS, INC.
5521 Wayne Ave.
Philadelphia, Pa. 19144

125cc (TWO STROKE)

MODEL	COBRA, CALIFORNIA & SCRAMBLER
Displacement—cc	123.6
Bore—MM	54
Stroke—MM	54
Number of cylinders	1
Oil-fuel ratio	1 to 20
Plug gap—inch	0.022
Point gap—inch	0.016
Ignition timing—Advance	Fixed
Degrees BTDC	29
Tire size—Front	2.75 x 18
Rear	3.00 x 18
Tire pressure psi—Front	22
Rear	28
Rear chain free play—inch	½
Number of speeds	4
Weight—Lbs. (Approx.)	205

MAINTENANCE

SPARK PLUG Spark plug electrode gap should be 0.022 inch. Standard spark plug is Beru 1348/2.

CARBURETOR. Del'Orto ME 18 BS carburetor is shown in Fig. BE1-1. Idle speed is adjusted at screw (7). Idle mixture needle (6) initial setting is 1 turn open. Turning the needle counter-clockwise leans the mixture. Clip (1) should be in center (2nd) notch of needle (3). Main jet (8) standard size is 76.

IGNITION AND ELECTRICAL. Ignition point gap can be checked and adjusted through slots in flywheel after the left side cover is removed. Point gap should be 0.016 inch (0.4 MM). The flywheel and crankcase are marked to indicate TDC and ignition

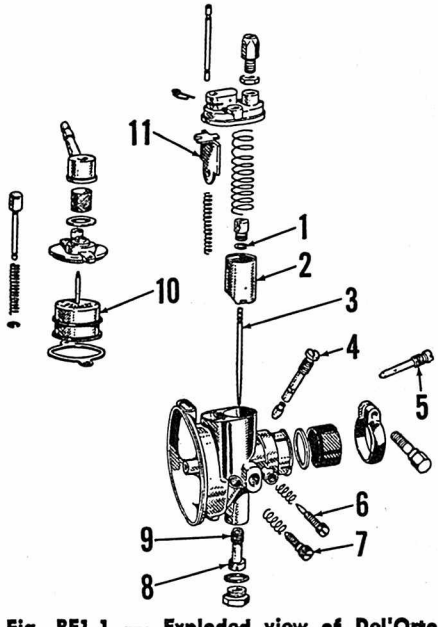


Fig. BE1-1 — Exploded view of Del'Orto carburetor. Idle mixture is adjusted at needle (6).

1. Clip
2. Throttle slide
3. Valve needle
4. Pilot jet
5. Minimum jet
6. Idle mixture needle
7. Idle speed screw
8. Main jet
9. Nozzle
10. Float
11. Choke slide

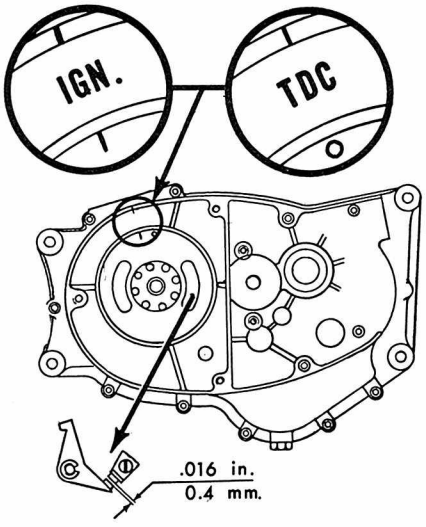


Fig. BE1-2 — When notch on flywheel is aligned with notch on crankcase, crankshaft is positioned for correct ignition point. When "O" on flywheel is aligned with notch in crankcase, piston is at TDC.

timing (29° BTDC) as shown in Fig. BE1-2. Timing is changed by moving the magneto stator plate in the elongated mounting holes after removing the flywheel and loosening the three stator plate retaining screws. Ignition should occur (points just open) when the notched mark on flywheel is aligned with notch in crankcase. Flywheel rotates counter-clockwise.

LUBRICATION. The engine is lubricated by mixing two stroke motor oil with the fuel. Ratio should be 1:15 for the first 1,000 miles; 1:20 after 1,000 miles. The gear box is lubricated with 40 fl. oz. of SAE 30 motor oil. Gear box oil should be drained and refilled every 3,000 miles. Oil should be maintained between marks on filler plug dipstick at right rear of crankcase.

CLUTCH CONTROLS. The clutch cable should be adjusted to provide the hand lever with some free play. Adjustment can normally be accomplished at end of cable. Additional adjustment is possible by turning the adjusting screw (20—Fig. BE1-6) in clutch lever under the engine left side cover.

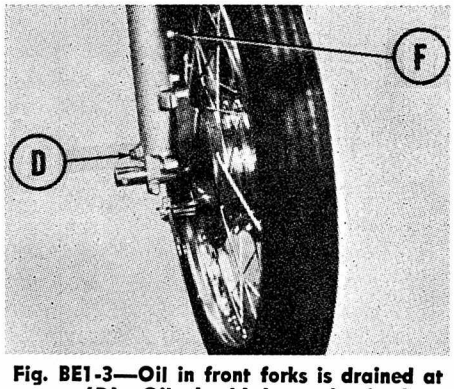


Fig. BE1-3—Oil in front forks is drained at screw (D). Oil should be maintained at level of filler screw hole (F).

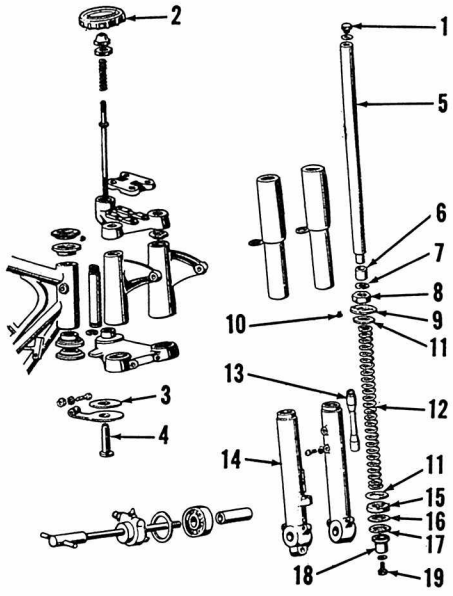


Fig. BE1-4—Exploded view of front suspension unit.

1. Top plug
2. Steering friction knob
3. Fiber washer
4. Friction nut
5. Tube
6. Bushing
7. Washer
8. Plug
9. Washer
10. Screw
11. Gaskets
12. Spring
13. Dampener
14. Lower sliding tube
15. Retainer
16. Washer
17. Oil seal
18. Bushing
19. Screw for dampener (13)

SUSPENSION. Each front suspension unit is drained at plug (D—Fig. BE1-3). Fill to the level of filler plug (F) with SAE 20 motor oil. Fluid in the front suspension should be checked every 1,000 miles and drained every 5,000 miles. The rear suspension units are available only as complete assembly and should be renewed if bent, leaking or otherwise damaged.

REPAIR

PISTON, RINGS AND CYLINDER. The piston can be removed after removing fuel tank, exhaust pipe, carburetor, cylinder head and cylinder. Standard cylinder bore diameter is 54.0-54.015 MM (2.165-2.166 in.). Piston to cylinder clearance should be 0.04-0.075 MM (0.0016-0.003 inch) when measured at bottom of piston skirt at right angles to piston pin. Wear limit is 0.1 MM (0.004 inch). Piston and rings are available in three oversizes. When installing piston, make certain that cut-away part of skirt is in toward rear (carburetor).

CONNECTING ROD AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Connecting rod, crankpin and roller bearings are removed by pressing the crankshaft apart. Crankshaft should be disassembled **ONLY** if required tools are available to correctly check and align the reassembled crankshaft.

CLUTCH. The manual, multiple disc wet type clutch is mounted on the right end of the transmission input shaft as shown in Fig. BE1-6. The clutch is actuated by lever (21) on left side and rods (23 & 38) which go through center of the input shaft. The actuating block (39) is used as drive key and disengaging block. When reassembling, smooth side of pressure plate (47) should be toward retaining ring (48). Tighten nut (52) to 36 Ft.-Lbs. torque.

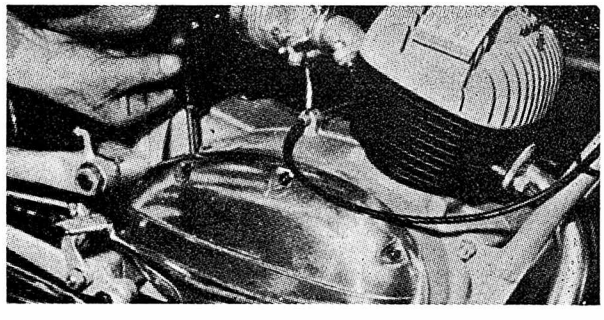


Fig. BE1-5—Oil level should be maintained between marks on dipstick attached to filler plug.

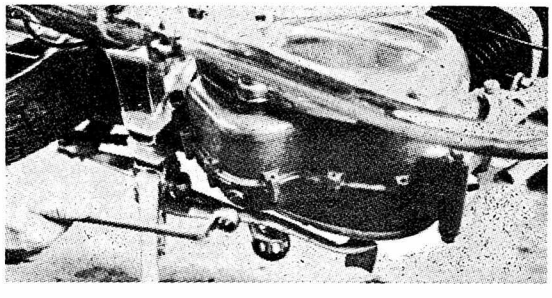


Fig. BE1-5A—View showing oil drain plug. Make certain that sealing washer is in good condition when replacing plug.

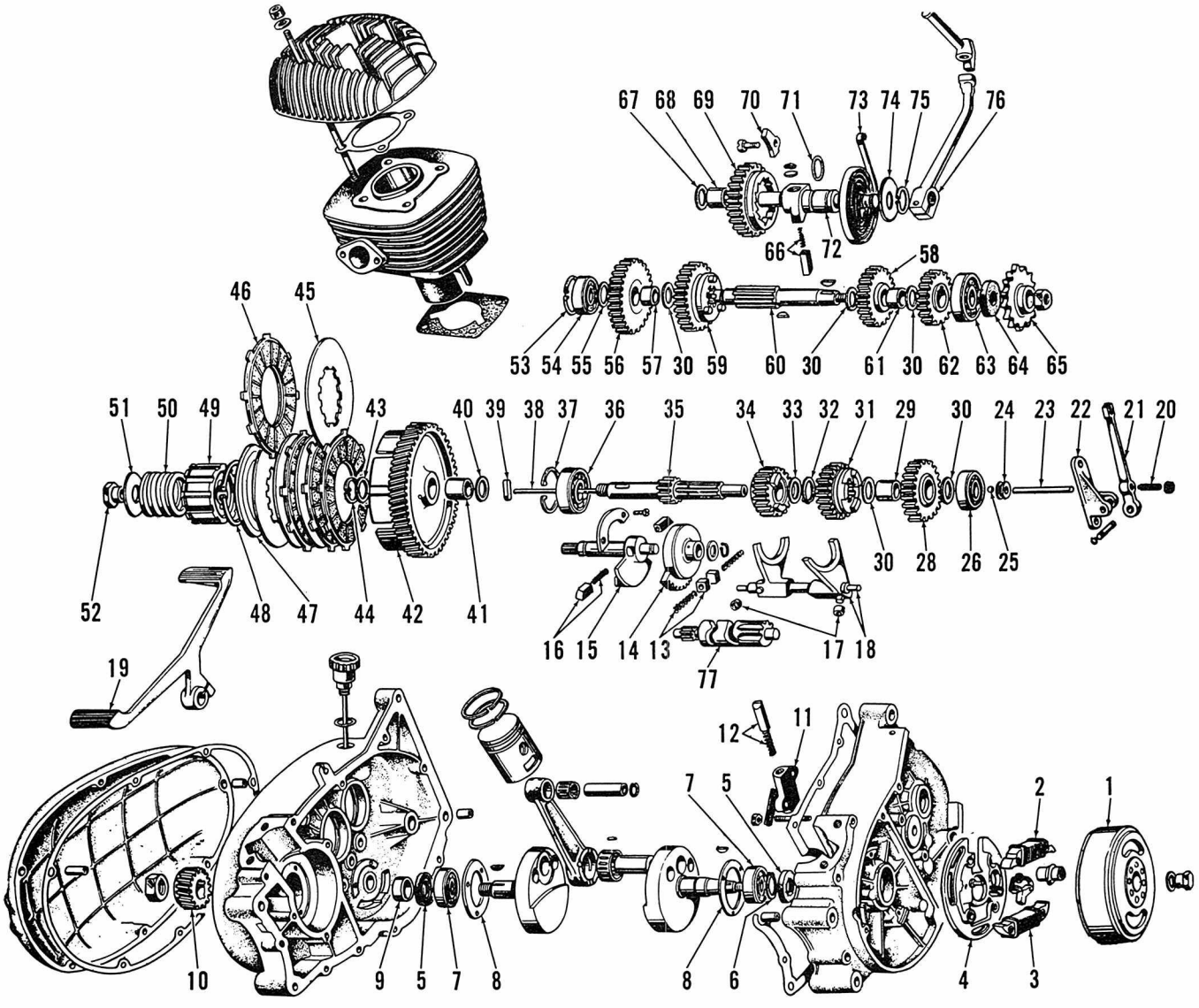


Fig. BE1-6—Exploded view of engine and transmission.

1. Flywheel
2. Ignition low tension coil
3. Lighting coil
4. Stator plate
5. Seals
6. Snap ring
7. Main bearings
8. Bearing retainers
9. Spacer
10. Crankshaft gear
11. Detent housing
13. Detent for shift drum
14. Preselector
15. Selector shaft
16. Ratchet pawls and spring
17. Shift fork rollers
18. Shift forks and rail
19. Shift pedal
20. Adjusting screw
21. Clutch lever
22. Bracket
23. Short rod
24. Oil seal
25. Ball
26. Bearing
28. Gear (4th)
29. Bushing
30. Washer
31. Sliding gear (3rd)
32. Snap ring
33. Washer
34. Gear (2nd)
35. Input shaft & gear (1st)
36. Bearing
37. Snap ring
38. Clutch rod
39. Actuating block
40. Thrust washer
41. Bushing
42. Clutch drum
43. Thrust washer
44. Snap ring
45. Steel driven plate
46. Friction disc
47. Pressure plate
48. Snap ring
50. Spring
51. Washer
52. Nut
53. Snap ring
54. Bearing
55. Washer
56. Gear (1st)
57. Bushing
58. Gear (3rd)
59. Sliding gear (2nd)
60. Output shaft
61. Bushing
62. Gear (4th)
63. Bearing
64. Seal
65. Output sprocket
66. Kickstarter ratchet
67. Washer
68. Bushing
69. Kickstarter gear
70. Plate
71. "O" ring
72. Kickstarter shaft
73. Return spring
74. Washer
75. Snap ring
76. Lever
77. Shift drum

CRANKCASE AND GEAR BOX. To disassemble the crankcase and gear box, the engine must be removed. Remove the cylinder head, cylinder, piston, magneto assembly, clutch and crankshaft drive gear. Remove the four nuts and eleven screws and separate the crankcase halves. Refer to Fig. BE1-6. When assembling, the gears and shaft can be assembled in the left half of crankcase and right half can be assembled over the shafts. The timing marks on selector shaft (14) gear and shift drum (77) gear must be aligned. Check alignment of timing marks after assembly through hole in right crankcase half.

BRIDGESTONE

BRIDGESTONE CYCLE CO., LTD.
Tokyo, Japan
ROCKFORD MOTORS, INC.
1911 Harrison Ave.
Rockford, Illinois 61101

HM AND BS-7 MODELS

MODEL	HM/S	BS-7S	BS-7D
Displacement-cc	50	50	50
Bore-MM	40	40	40
Stroke-MM	39.5	39.5	39.5
Number of cylinders	1	1	1
Oil-fuel ratio	1 to 20	1 to 20	1 to 20
Plug gap-inch	0.024-0.027	0.024-0.027	0.024-0.027
Point gap-inch	0.012-0.016	0.012-0.016	0.012-0.016
Ignition timing	fixed	fixed	fixed
degrees BTDC	23	23	23
Electrical system voltage	6	6	12
Battery terminal grounded	negative	negative	negative
Tire size—front & rear	2.25 X 17	2.25 X 17	2.25 X 17
Tire pressure psi—front	22	22	22
rear	28*	28*	28*
Rear chain free play-inch	¾	¾	¾
Number of speeds	3	3	3
Weight-lbs. (Approx.)	153	149.6	155

*Rear tire pressure should be 32 psi for carrying passenger.

MAINTENANCE

SPARK PLUG. Spark plug electrode gap should be 0.024-0.027 inch. Recommended plug for normal use is NGK type B-6, AC type 45, Champion J-8J, Autolite A7, Bosch W145T3, KLG type TFS50 or Lodge C14.

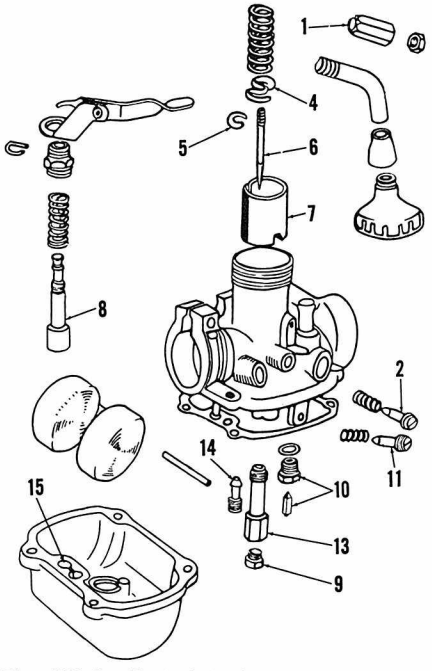


Fig. BS1-1—Exploded view of typical carburetor used on HM/S, 7D and 7S models.

1. Throttle cable adjuster
2. Idle speed adjusting screw
4. Retainer
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Fuel inlet valve
11. Idle mixture needle
13. Atomizer
14. Pilot jet
15. Starting jet

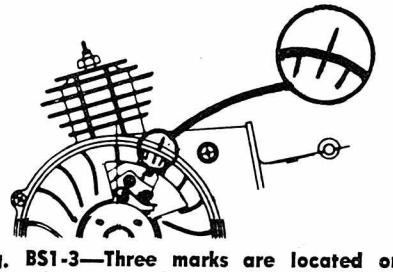


Fig. BS1-3—Three marks are located on fan and one on left crankcase flange. The first mark indicates 28 degrees BTDC; center mark, 23 degrees BTDC and last mark; 18 degrees BTDC. When timing ignition, center mark and mark on crankcase flange should be aligned as ignition points just open

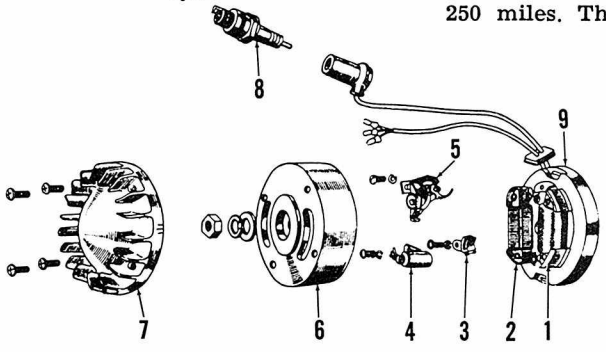


Fig. BS1-4 — Exploded view of flywheel magneto used on standard models. Lighting coil (2) charges battery via a selenium rectifier.

1. Ignition coil
2. Lighting coil
3. Oil felt
4. Condenser
5. Ignition points
6. Flywheel
7. Fan
8. Spark plug
9. Stator

CARBURETOR. Idle speed is adjusted at screw (2—Fig. BS1-1) and idle mixture at needle (11). Approximate setting for idle mixture needle (11) is 1 turn open for HM/S, 2 turns open for 7D and 7S. Normal position of clip (5) is in second groove from top of valve needle (6). Normal size of main jet (9) is 70 for HN/S and 80 for 7D and 7S.

IGNITION AND ELECTRICAL. A flywheel type magneto is used on standard models and a combination starter and generator is used on deluxe models. Ignition point gap should be 0.012-0.016 inch. Ignition should occur (points just open) at 23 degrees BTDC. Three marks are provided on the fan and one mark is located on the left crankcase flange as shown in Fig. BS1-3. The center mark (23 degrees) and the mark on crankcase can be used for ignition timing. On magneto models, stator (9—Fig. BS1-4) can be rotated in the elongated mounting holes to change ignition timing. On deluxe models, ignition point base plate (12—Fig. BS1-5) can be moved in the elongated holes to change ignition timing. Commutator insulation should be undercut 0.020 in. and commutator should be turned if grooved more than 0.020 in. Condenser capacity is 0.24 Mfds. for all models.

LUBRICATION. The engine is lubricated by mixing two stroke motor oil with the fuel. Ratio should be 1:15 for the first 250 miles; 1:20 after 250 miles. The gear box contains 1

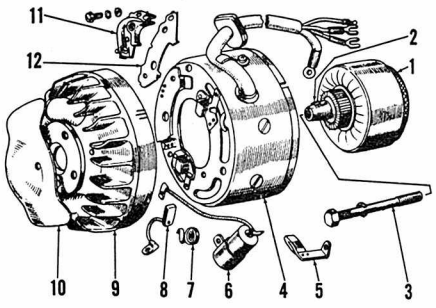


Fig. BS1-5—Exploded view of starter-generator unit used on deluxe models.

1. Armature
2. Flywheel drive key
3. Armature retaining screw
4. Stator and field windings
5. Oil felt
6. Condenser
7. Brush spring (2 used)
8. Brush (2 used)
9. Fan
10. Cover
11. Ignition points
12. Ignition point base plate

quart of SAE 10W/30 multigrade engine oil. Gear box oil should be maintained at level of mark on filler plug dipstick. Gear box oil should be changed every 1000 miles.

CLUTCH CONTROL. The automatic clutch used on HM/S models, is shown in Fig. BS1-10. Adjustment is accomplished after removing small cover from crankcase right side cover. Clearance between adjusting screw

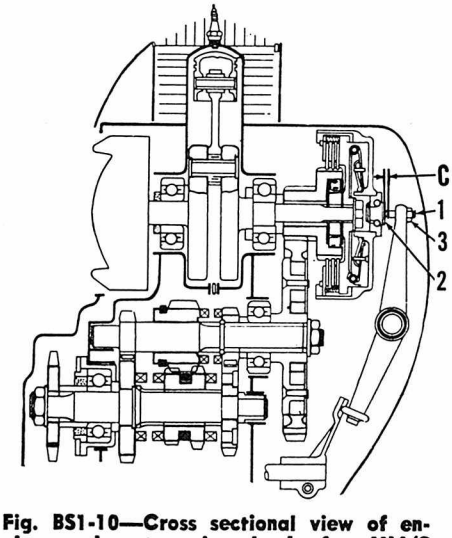


Fig. BS1-10—Cross sectional view of engine and automatic clutch for HM/S models. Clearance (C) should be 0.040-0.063 in.

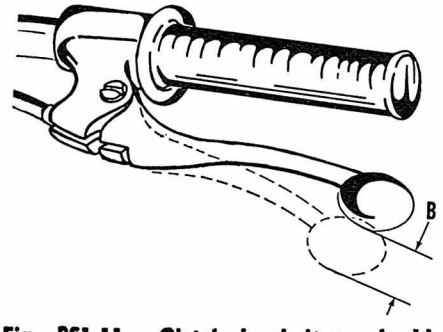


Fig. BS1-11 — Clutch hand lever should have 3/8-5/8 in. free play at B on 7D and 7S models.

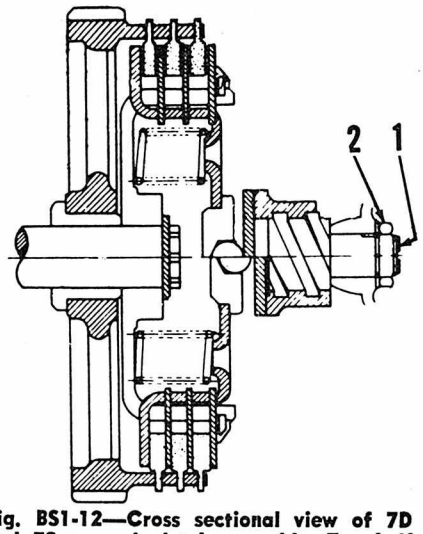


Fig. BS1-12—Cross sectional view of 7D and 7S manual clutch assembly. Top half shows clutch disengaged. Adjusting screw is shown at 1 and locknut at 2.

(1) and push rod (2) should be 0.40-0.063 in. Normally the recommended clearance can be obtained by turning the adjusting screw (1) in until it just contacts push rod (2), then turn screw out 1½ turns and tighten locknut (3). If clutch slips, turn adjusting screw out. If clutch does not disengage with engine idling, turn adjusting screw in.

The manual clutch used on 7D and 7S models, is normally adjusted at cable adjuster to provide 3/8-5/8 in. free play at (B—Fig. BS1-11) hand lever. If cable adjuster is nearly screwed out of right crankcase cover, additional adjustment is provided at screw (1—Fig. BS1-12) on right side cover.

REPAIRS

PISTON, RINGS AND CYLINDER. The piston can be removed after removing cowling, exhaust pipe, carburetor, cylinder head and cylinder. Standard cylinder bore diameter is 1.575-1.576 in. Piston skirt clearance should be 0.003 in. with wear limit of 0.004 in. Ring end gap should be 0.006-0.010 in. Mark on side of rings should be toward top of piston and arrow on top of piston should point toward exhaust port. Piston and rings are available in standard size and two oversizes.

CONNECTING ROD AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Connecting rod, crankpin and crankshaft are available only as a complete assembly and should NOT be disassembled.

CRANKCASE AND GEAR BOX. To disassemble crankcase and gear box, the engine must first be removed. Remove the cylinder head, cylinder, piston, clutch cover, clutch, flywheel and magneto (starter-generator assembly on deluxe models). Remove the screws that hold crankcase halves together and carefully separate the halves. Be careful not to damage sealing surfaces of crankcase. Refer to Figs. BS1-10 and BS1-18.

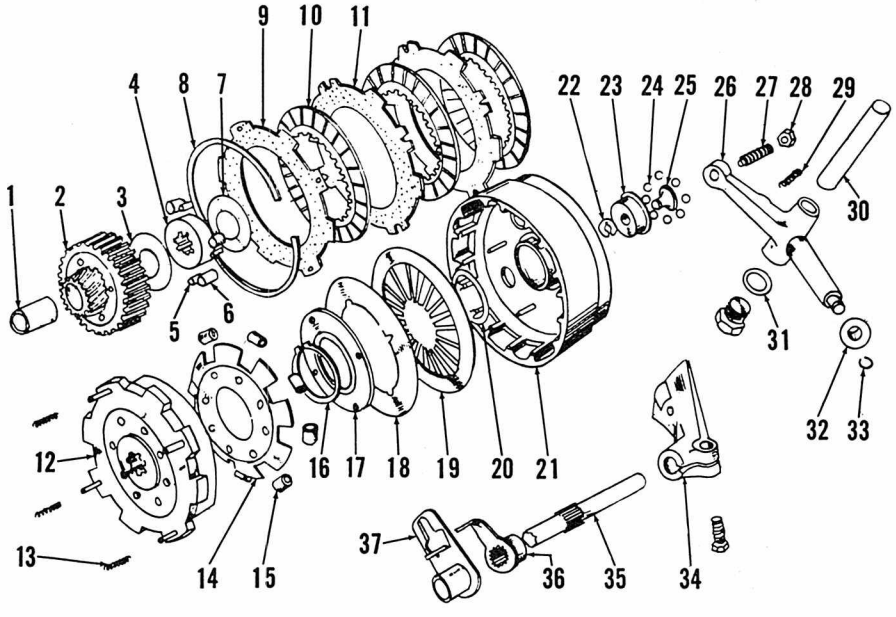


Fig. BS1-15—Exploded view of automatic clutch used on HM/S model.

1. Bushing
2. Clutch gear and hub
3. Washer
4. Over-running clutch inner race
5. Roller (5 MM)
6. Roller (8 MM)
7. Washer
8. Snap ring
9. Clutch plate
10. Friction discs (3 used)
11. Inner clutch plates (2 used)
12. Pressure plate
13. Return springs (4 used)
14. Roller retainer
15. Centrifugal rollers (8 used)
16. Snap ring
17. Plate
18. Thrust washer
19. Clutch spring
20. Washer
21. Clutch drum
22. Snap ring
23. Release bearing
24. Release bearings (8 used)
25. Push rod
26. Release arm
27. Adjusting screw
28. Locknut
29. Spring
30. Release arm shaft
31. Seal
32. Roller
33. Snap ring
34. Release cam
35. Gear change shaft
36. Shift arm
37. Shift plate

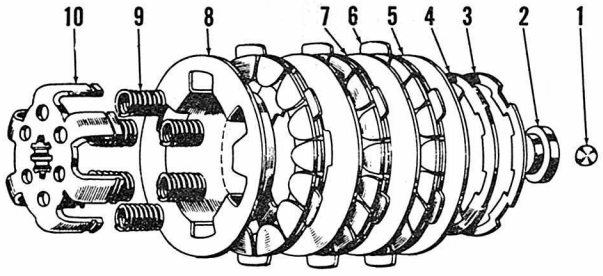


Fig. BS1-16 — Exploded view of manual clutch used on 7D and 7S models. Clutch drum is shown at (16—Fig. BS1-18).

1. Release ball
2. Release bearing seat
3. Snap ring
4. Washer
5. Outer clutch plate
6. Friction disc (3 used)
7. Clutch plates (2 used)
8. Pressure plate
9. Springs (6 used)
10. Clutch hub

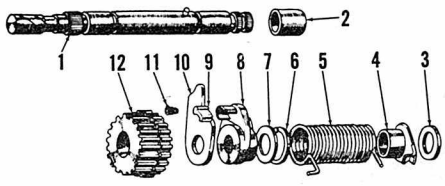


Fig. BS1-20—Exploded view of typical kick starter assembly.

1. Starter pedal shaft
2. Cover
3. Washer (15 MM)
4. Spring hook
5. Return spring
6. Snap ring
7. Washer (14 MM)
8. Ratchet pawl
10. Ratchet arm stop
11. Ratchet spring
12. Kick starter gear

1. Washer
2. Main bearing 2 used on HM/S, 3 used on 7D & 7S
3. Crankshaft assembly
4. Crankshaft gear (7D and 7S)
5. Crankshaft end play shims
6. Woodruff keys
7. Crankshaft nut
8. Transmission input shaft and low gear
9. Third gear (sliding)
10. Snap ring
11. Second gear
12. Spacer
13. Bearing holder
14. Ball bearing
15. Retainer
16. Clutch drum (7D and 7S)
17. Second gear
18. Third gear (sliding)
19. Output shaft
20. Bushing
21. First gear
22. Spacer
23. Spacer
24. Output sprocket
25. Output shaft right side bushing
26. Bushing retainer

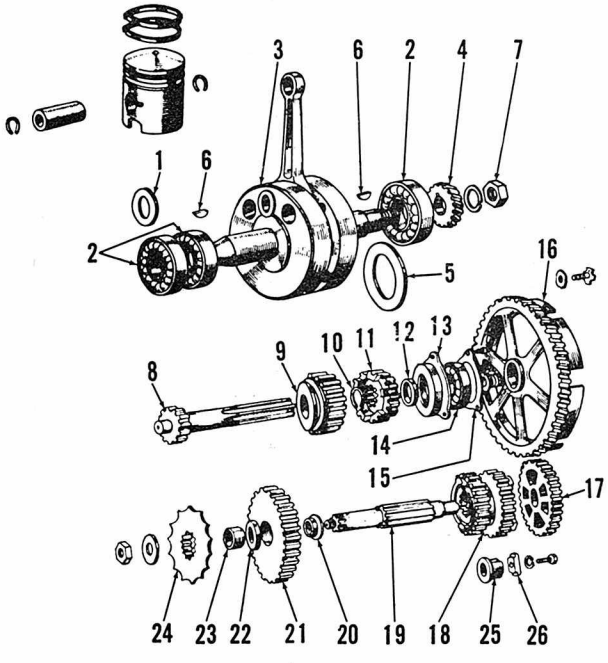


Fig. BS1-18—Exploded view of crankshaft and transmission for 7D and 7S models. HM/S is similar except clutch is located on crankshaft.

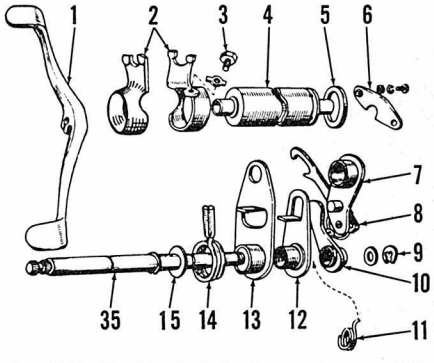


Fig. BS1-22—Exploded view of gear shift assembly. On HM/S models, clutch cam (34—Fig. BS1-15) is attached to right end of shaft (35). Shift forks (2) are interchangeable.

1. Gear shift pedal
2. Shift forks
3. Fork guide screws (2 used)
4. Shift drum
5. Washer
6. Retainer plate
7. Gear change arms
8. Arm spring
9. Snap ring
10. Shift drum stop
11. Stop spring
12. Shift plate
13. Shift plate stop
14. Pedal return spring
15. Washer
35. Pedal shaft

BRIDGESTONE 50, 60, 90 AND 100CC (ROTARY VALVE MODELS)

MODEL	50 Sport	60 Sport	90 Standard, Trail, Mountain & Sport	100 Sport, GP & TMX
Displacement-cc	50	58	88.4	99
Bore-MM	39	42	50	53
Stroke-MM	42	42	45	45
Number of cylinders	1	1	1	1
Oil-fuel ratio	1 to 20	1 to 20	*Oil pump	Oil pump
Plug gap-inch	0.025-0.028	0.025-0.028	0.025-0.028	0.025-0.028
Point gap-inch	0.012-0.016	0.012-0.016	0.012-0.016	0.012-0.016
Ignition timing-advance	Fixed	Fixed	Fixed	Fixed
Degrees BTDC	19	19	21	21
Electrical system voltage	6	6	6	6
Tire size-front and rear	2.25 X 17	2.25 X 17	2.50 X 17	2.50x17
Tire pressure psi-front	24-26	24-26	24-26	24-26
Rear	26-30	26-30	26-30	26-30
Rear chain free play-inch	¾	¾	¾	¾
Number of speeds	4	4	4	4

*Early models, without oil pump, use 1 to 20 oil to gasoline mix.

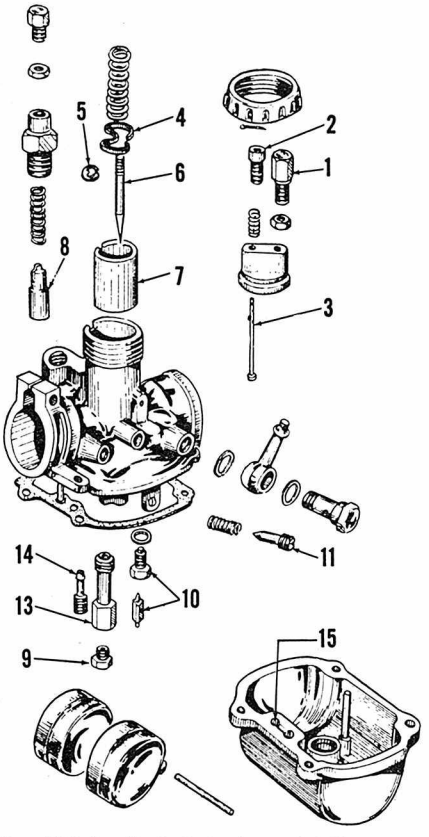


Fig. BS2-1—Exploded view of Mikuni VM type carburetor.

1. Throttle cable adjuster
2. Idle speed adjuster
3. Idle speed rod
4. Retainer
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Inlet valve
11. Idle mixture screw
13. Needle jet
14. Pilot jet
15. Starter jet

MAINTENANCE

SPARK PLUG. Spark plug electrode gap should be 0.025-0.028 inch. Recommended plugs are listed in the following table. The cold plug listed is for sustained high speed operation and may be too cold for starting and warm-up. Plug used for scrambles and short track should usually be between the normal and cold plugs listed.

	Champion	NGK
50 Sport		
Normal use	J-4	B-7
Cold plug	J-57R	B-8N
60 Sport		
Normal use	J-4	B-8
Cold plug	J-57R	B-8N
90 CC Models		
Normal use	L-5	B-7H
Cold plug	L-54R	B-9H
100 CC Models		
Normal use	L-57R	B-8H
Cold plug	L-54R	B-9HN

CARBURETOR. Refer to Fig. BS2-1 for exploded view of Mikuni carburetor typical of type used on all models. Idle speed is adjusted at (2) after removing the carburetor top cover (rubber). Idle mixture is adjusted at needle (11) after carburetor side cover is removed. Approximate setting for idle mixture needle (11) is 1½ turns open for 90 Sport models and all 100 cc models; 1¾ turns open for all other models. Clip (5) should be installed in third groove from top of needle (6). Float level (H—Fig. BS-2) should be $\frac{23}{32}$ inch for 90 Sport and all 100 cc models, $\frac{25}{32}$ inch for all other models. Main jet sizes are as follows.

50 & 60 cc Models 110
90 cc (VM15SC carburetor) 120-130
90 cc (VM17SC carburetor) 95-100
100 cc (VM18SC carburetor) 110
100 cc (22 MM carb.) 180

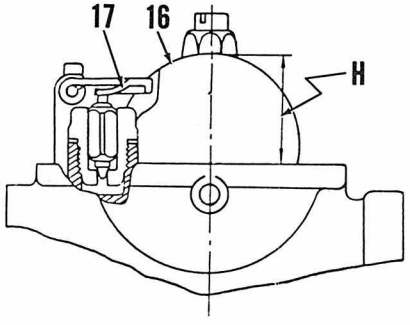


Fig. BS2-2—Float level (H) is adjusted by bending tang (17). Float bowl gasket should be removed when measuring.

IGNITION AND ELECTRICAL. Energy transfer type ignition is used with the low tension ignition coil and lighting coil contained under the flywheel. Ignition breaker point gap should be 0.012-0.016 in. and points should open at 19 degrees BTDC on 50 and 60 cc models, 21 degrees BTDC on 90 and 100 cc models. Ignition timing marks are shown in Fig. BS2-3. Timing can be changed a small amount by varying gap within the range of 0.012-0.016 in., however additional adjustment is accomplished by rotating stator plate (2—Fig. BS2-4) in the elongated mounting holes. Condenser capacity should be 25-30 Mfd.

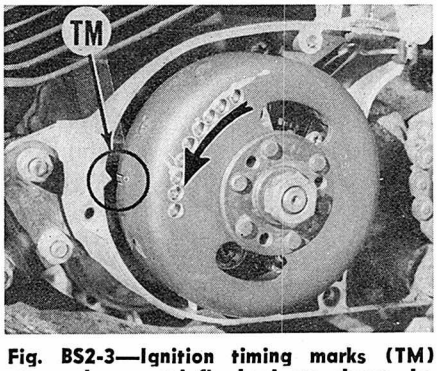


Fig. BS2-3—Ignition timing marks (TM) on crankcase and flywheel are shown. Ignition timing can be retarded 2 degrees, but should not occur before crankcase mark and flywheel mark are aligned.

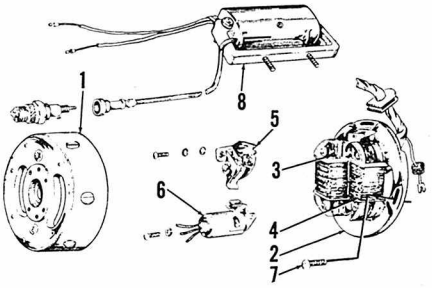


Fig. BS2-4—Exploded view of magneto assembly (ignition and lighting systems). Ignition timing can be changed by rotating stator plate (2) after loosening three screws (7).

1. Flywheel
2. Stator
3. Primary ignition coil
4. Lighting coil
5. Ignition points
6. Condenser
7. Screws
8. High tension ignition coil

Flywheel retaining nut should be tightened to 300 in.-lbs. of torque.

NOTE: Ignition timing is correct when the breaker points just open with flywheel mark 2 degrees ($\frac{3}{32}$ inch) past the mark on crankcase as shown in Fig. BS2-3. Timing should never be advanced beyond the center of crankcase timing mark.

LUBRICATION. On models without oil injection, the engine is lubricated by mixing two stroke motor oil with the fuel. Ratio should be 1:15 for the first 250 miles, 1:20 after 250 miles. On 90 and 100cc models with oil injection, a separate oil tank and metering type pump is used. Refer to the following OIL INJECTION section.

The gear box is lubricated by SAE-10W/30 motor oil. Capacity for 50 or 60cc models is 16 oz. and 25 oz. for 90 and 100cc models. Oil level should be maintained at level of plug (1—Fig. BS2-5).

OIL INJECTION. The oil injection system automatically meters and pumps oil from a separate tank to the rotary valve cover plate. The oil tank should be filled with two stroke motor oil and should **never** be allowed to run dry. The oil pump and metering

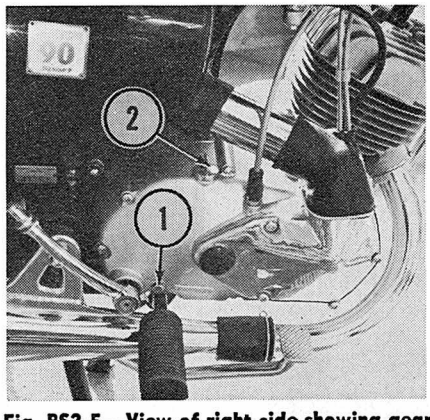


Fig. BS2-5—View of right side showing gear box oil level screw (1) and filler plug (2).

unit is located under the right side cover plate as shown in Fig. BS2-6.

For the first 250 miles, it is necessary to mix ½ pint of two stroke motor oil with each 1.25 gallons of gasoline in the fuel tank (1 to 20 ratio). After the first 250 miles, it is not necessary to add oil to the fuel.

The engine oil pump drive gears are lubricated by a small amount of SAE 30 motor oil contained in the housing. Filling is accomplished after removing screw (1—Fig. BS2-6) using a pressure type oil can. Oil should be maintained at level of filler hole.

If the system is drained or the pump unit renewed, air should be bled from the system by loosening inlet fitting (2) and allowing oil to flow from tank to the open connection. Tighten fitting (2) and operate kick starter with key turned off and throttle open until the outlet oil line, from fitting (3) to the rotary valve cover, is full of oil. If oil does not flow correctly, check oil lines, screen (in oil tank) and check valves. The outlet union bolt (3) should have spring in union bolt, with check ball against seat in pump. If equipped with inlet check valve, ball should be against inside of brass inlet union (2) and the spring should be toward pump. The outlet union bolt (3) is steel with spring inside. The outlet check ball seats against the pump.

To adjust the pump control cable, close the throttle and turn cable adjuster (4—Fig. BS2-7) until cable housing has $\frac{1}{16}$-inch free play. Normally, no other adjustment will be necessary. To adjust the pump, it is necessary to remove the unit from the side of engine and separate the pump halves. Be careful not to lose the check valve balls or the pump spring. Turn the pump gear (G—Fig. BS2-8) until the cam (A) is against pin (B). Loosen lock nut (C) and turn adjusting screw (D) clockwise until the highest part of the cam (A) just barely touches the pin (B). Check to make certain that cam is just touching the pin. From this setting, carefully turn the adjusting screw (D) counter-clockwise exactly ¾-turn and tighten lock nut (C). NOTE: If pump adjustment is incorrect, engine may be damaged. Reinstall pump, refill drive gear lubricant at screw (1—Fig. BS2-6) and readjust cable. Make certain that pump spring is installed in end of pump gear and check valves are correctly installed in union bolts (2 & 3—Fig. BS2-6).

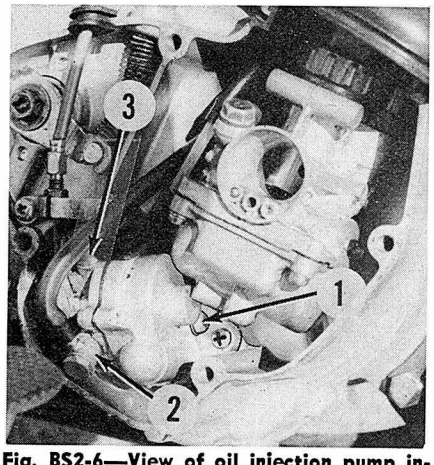


Fig. BS2-6—View of oil injection pump installed. Pump drive gears are lubricated by oil at screw (1). The oil inlet line runs from the tank to inlet union (2). Outlet union is shown at (3).

CLUTCH CONTROLS. The clutch is located on right end of transmission input shaft. The hand lever should have ⅜-⅝ in. free play at (B—Fig. BS2-9).

To adjust the clutch, remove the carburetor cover from right side of engine, loosen lock nut (4—Fig. BS2-10). Turn cable adjuster (3) until the distance between pivot pin (5) and spring pin (6) is 1¼ inches, then tighten lock nut (4). Loosen lock nut (1) and turn the adjusting screw (2) until free play at end of hand lever is ⅜-⅝ inch (B—Fig. BS2-9). Make certain nut (1—Fig. BS2-10) is tightened after adjustment is complete.

SUSPENSION. Each front suspension unit contains 6 fl. oz. of hydraulic jack oil for all 50 and 60cc models; 6 to 7 fl. oz. for 90 and 100cc models. Fluid level should be 6½-7 inches from bottom of fork tube. Oil level can be measured using a long wire through filler screw hole in top fork brace. Rear units are not repairable and should be renewed if bent, leaking or damaged.

REPAIR

PISTON, RINGS AND CYLINDER. The piston can be removed after removing the exhaust pipe, cylinder head and cylinder. Refer to the following specifications.

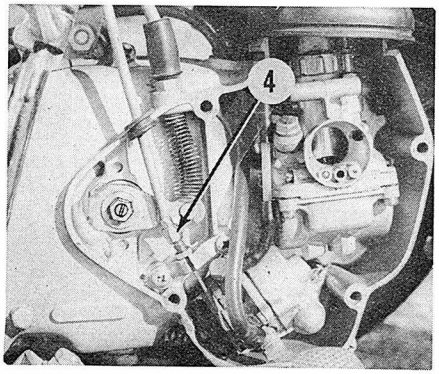


Fig. BS2-7—Oil injection control cable is adjusted at (4). Refer to text.

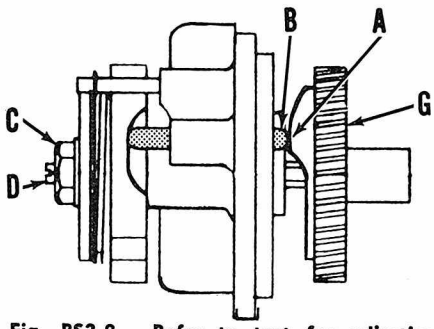


Fig. BS2-8 — Refer to text for adjusting pump stroke. Cam (A) is part of gear (G).

A. Cam
B. Pin
C. Lock nut
D. Adjusting screw

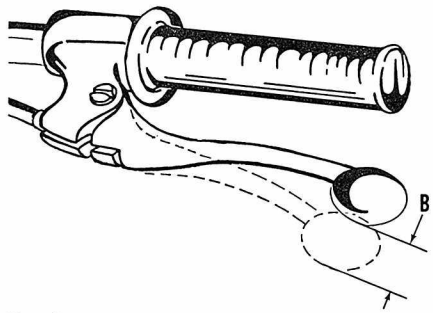


Fig. BS2-9—Clutch hand lever should have 3/8-5/8 in. free play at B.

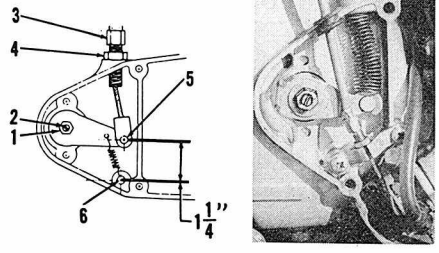


Fig. BS2-10—Clutch adjustment points are shown. Refer to text for adjustment method.

1. Lock nut
2. Adjusting screw
3. Lock nut
4. Cable adjuster
5. Pivot pin
6. Spring pin

Ring end gap—

All Models .....0.006-0.020 in.

Standard Cylinder bore nominal diameter.

50 cc .....39.025 MM
1.5365 in.
60 cc .....42.035 MM
1.655 in.
90 cc (except 90 Sport) ..50.07 MM
1.97 in.
90 Sport .....50.00 MM
1.968 in.
100cc 53.00MM
2.086 in.

Piston skirt-cylinder bore clearance

50 & 60 cc 0.0025-0.0050
90 & 100 cc—
Iron cylinder .....0.0025-0.004 in.
Chrome bore .....0.0015-0.0025 in.

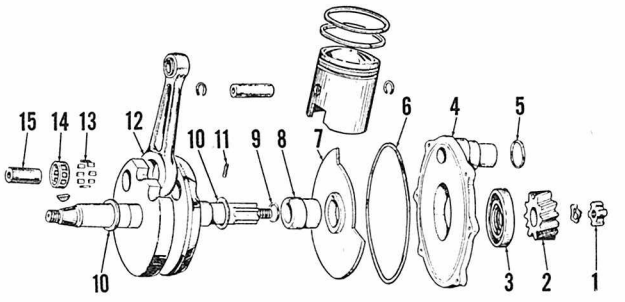


Fig. BS2-14—Exploded view of early crankshaft and associated parts. Drive collar (8) and rotary valve (7) were changed on later models and "O" ring (9) is not used.

Compression Pressure—

50 & 60cc .....90 psi Minimum
90 & 100cc .....100 psi Minimum

Oversize pistons and rings are available for all models with cast iron cylinder. The piston and rings for use in the cast iron cylinders (50, 60 & 90cc except 90 Sport) are different than type used in chrome plated aluminum cylinders (90 Sport and 100 cc models) and **must** not be interchanged. Pistons for cast iron cylinders can be identified by the small center hole in top of piston. Piston for aluminum cylinder has a small flat spot in center. Rings for cast iron cylinder are chrome plated and **must not** be installed in chrome plated aluminum cylinder (90 and 100cc Sport models). For all models, mark "EX" on top of piston should be installed toward exhaust port. Ring locating pins in piston grooves should be toward rear and rings should be installed so that ends correctly engage locating pins. Tighten the cylinder head stud nuts to 125 inch pounds torque.

CONNECTING ROD AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Connecting rod side play (shake) at piston pin end should not exceed 0.125 in. If play at end of rod is excessive, crankpin, connecting rod and bearings should be renewed. The connecting rod is removed by pressing crankshaft apart. Crankshaft should be disassembled **only** if required tools are available to correctly check and align the reassembled crankshaft.

When installing, crankshaft end play is adjusted by adding shims (10—Fig. BS2-14). End play should be 0.003-0.020 in. for all models. Refer to Fig. BS2-18 for installing later type rotary valve. Crankshaft gear (2—Fig. BS2-14) should be installed with undercut side of gear toward outside. Crankshaft nut (1) is left hand thread and should be tightened to 250 inch pounds of torque.

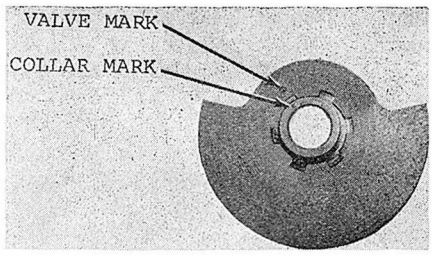


Fig. BS-2-18—On later type rotary valve, the mark on the splined collar must be aligned with mark on valve.

CLUTCH. The multiple disc, wet type clutch is mounted on the right end of the transmission input shaft and can be removed after removing the crankcase right side cover.

Friction discs (16—Fig BS2-16)—
Thickness .....0.1161-0.1201 in.
Wear limit .....0.1083 in.
Plates (17)—
Thickness .....0.0433-0.0472 in.
Wear limit .....0.0394 in.
Warpage .....less than 0.012 in.
Plate (15)—
Thickness .....0.0748-0.0787 in.
Wear limit .....0.0709 in.
Warpage .....less than 0.012 in.

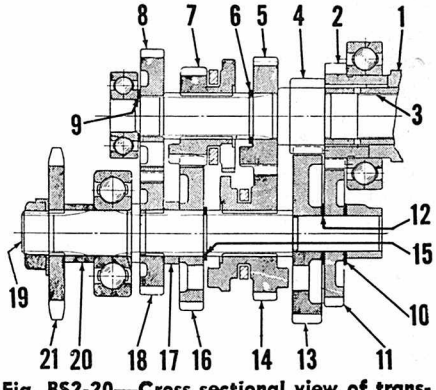


Fig. BS2-20—Cross sectional view of transmission assembly. Refer to Fig. BS2-21 for legend.

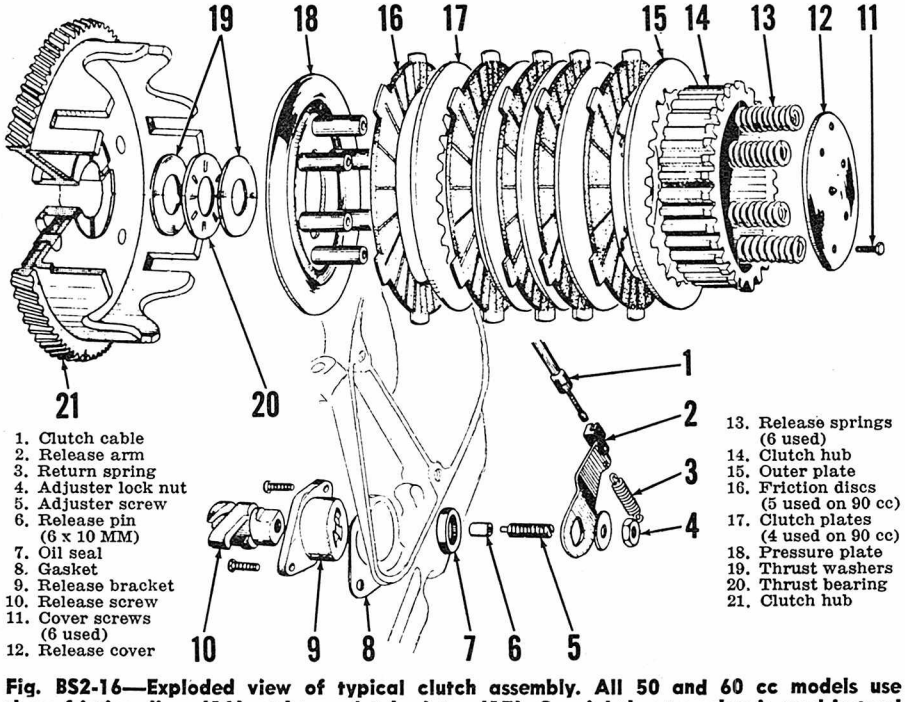


Fig. BS2-16—Exploded view of typical clutch assembly. All 50 and 60 cc models use three friction discs (16) and two clutch plates (17). Special thrust washer is used instead of parts (19 & 20) on later models.

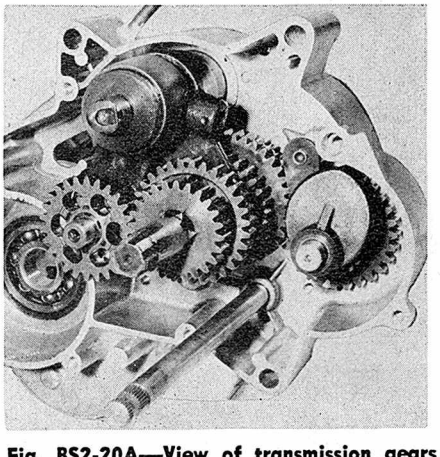
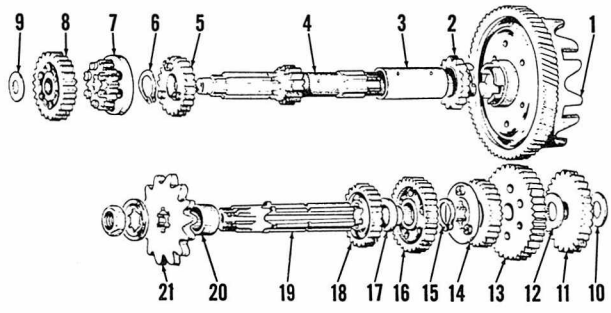


Fig. BS2-20A—View of transmission gears and shafts installed in the right crankcase half.



1. Clutch drum
2. Starter gear
3. Bushing
4. Input shaft and first gear
5. Third gear
6. Snap ring
7. Second (sliding) gear
8. Fourth gear
9. Thrust washer (12 MM)
10. Thrust washer (13 MM)
11. Starter idler gear
12. Thrust washer (13 MM)
13. First gear
14. Third (sliding) gear
15. Snap ring
16. Second gear
17. Spacer
18. Fourth gear
19. Output shaft
20. Spacer
21. Output sprocket

Fig. BS2-21—Exploded view typical of transmission gears and shafts.

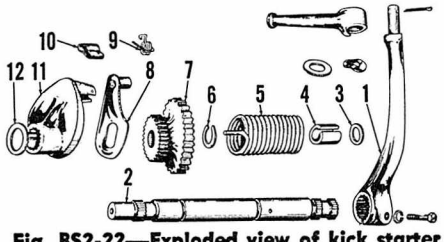


Fig. BS2-22—Exploded view of kick starter assembly. Gear (7) meshes with gear (11-Figs. BS2-20 and BS2-21).

1. Starter pedal
2. Starter shaft
3. Washer (15 MM)
4. Spring spacer
5. Pedal return spring
6. Snap ring
7. Starter gear
8. Ratchet arm stop
9. Ratchet spring
10. Ratchet pawl
11. Ratchet arm
12. Thrust washer (12 MM)

On all models, outer clutch plate (15—Fig. BS2-16) is thicker than other plates (17). Screws (11) should be tightened to 40 in. lbs. torque. The clutch retaining nut should be torqued to 110 inch pounds for 50 & 60cc models, 120 inch pounds for 90 & 100cc models. The release screw (10) can be installed in bracket (9) three different ways. When correctly installed, flats for release arm (2) will be horizontal, when end of screw (10) is flush with face of bracket (9). Make certain that release plunger (6) is correctly located in release screw before installing cover.

CRANKCASE AND GEAR BOX. The rotary valve, located on right end of crankshaft, can be removed after removing carburetor, clutch, crankshaft gear (2—Fig. BS2-14) and valve cover plate (4). Care should be taken to prevent valve from absorbing water or becoming too dry. After washing valve in solvent, be sure to wipe with oil to prevent complete drying out. On late type valves, valve must be timed to the splined collar as shown in Fig. BS2-18.

Rotary valve (7—Fig. BS2-14)

Thickness .....0.1161-0.1181 in.
wear limit .....0.1043 in.

Crankcase halves can be separated after removing cylinder, piston, magneto, output sprocket, snap ring from gear change shaft and the screws attaching crankcase halves together. Crankshaft and transmission shafts should remain in the right crankcase half. It will be necessary to carefully bump the left end of crankshaft and transmission shaft when separating, to release the bearing from these shafts. Refer to Figs. BS2-20 thru BS2-

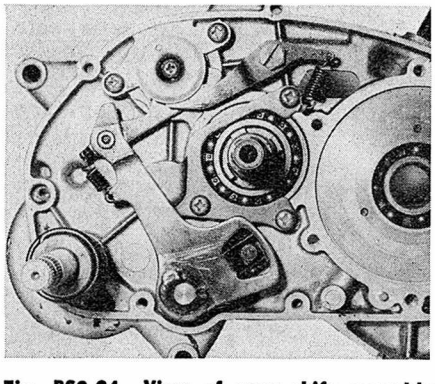


Fig. BS2-24—View of gear shift assembly installed. Model shown is 100 GP, however other models are similar.

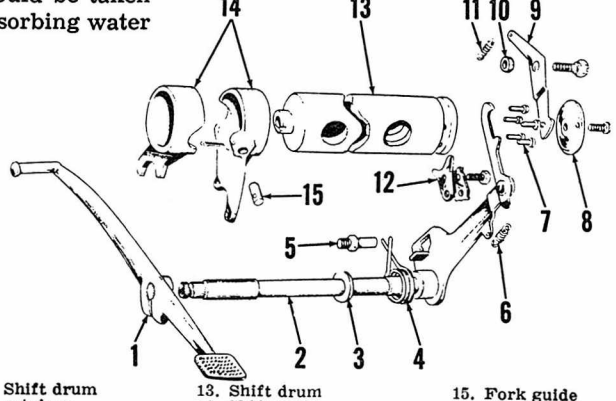


Fig. BS2-23 — Exploded view of gear shift assembly. Shift forks (14) are interchangable.

1. Shift pedal
2. Shift shaft
3. Washer (12 MM)
4. Pedal return spring
5. Return spring pin
6. Shift arm spring
7. Shift pins (5 used)
8. Pin holder
9. Shift drum stop
10. Spacer (6 MM)
11. Stop spring
12. Shift drum retainer
13. Shift drum
14. Shift forks
15. Fork guide pins (2 used)

SPEED TUNING

100 cc Models

The following modifications are suggested by the manufacturer for increased performance. Any change from original configuration will probably decrease the service life of an engine and, if changes are carelessly done, may decrease power and cause extensive damage. These specifications are for a guide only and will void warranty. With the following modifications horsepower and torque peak will occur at approximately 10,000 RPM and will probably necessitate changes in final drive sprocket ratio.

SPARK PLUG AND IGNITION. The coldest plug that can be used without excessive fouling should be installed. Plug readings should be carefully checked when selecting plug heat range. An NGK type B-9HN or Champion L-54R plug is suggested. The correct plug for racing application may be too cold for starting and warming engine up.

Breaker point gap should be set at 0.25-0.30 MM (0.010-0.012 inch) for racing instead of standard gap. The breaker points should just open at 23-24 degrees BTDC. The piston position at 23-24 degrees is 2.3 MM (0.090 inch) Before TDC.

Ignition may be changed to total loss battery ignition by using a different coil and a 12-volt battery. If total loss ignition is used, ignition low tension coil, charging coil and flywheel may be removed.

CARBURETOR. A Mikuni 22 MM carburetor should be adapted for use. Main jet size necessary for 22 MM carburetor should be approximately #180. A suggested method of adapting the larger carburetor is to remove the carburetor adapter tube from rotary valve cover and weld a larger tube in place as shown in Fig. BST2-1.

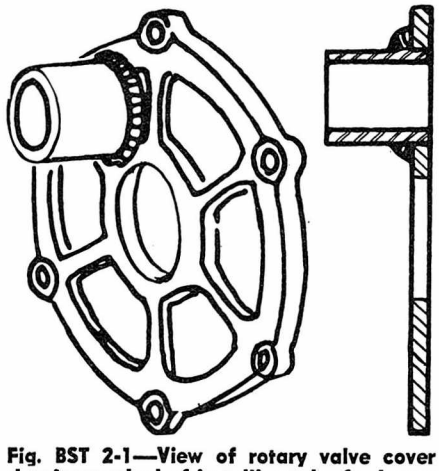


Fig. BST 2-1—View of rotary valve cover showing method of installing tube for larger carburetor. Outside diameter of tube must fit carburetor and inside diameter of tube should match carburetor bore.

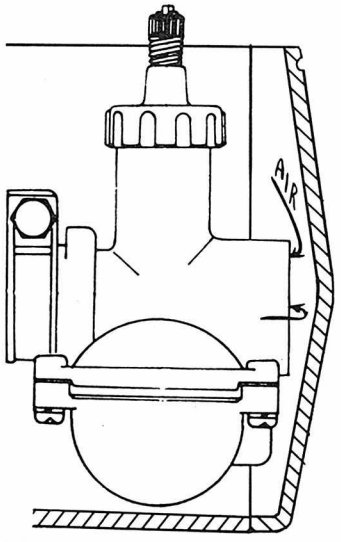


Fig. BST 2-2—It may be necessary to modify carburetor cover or space cover out to prevent restriction of air to carburetor.

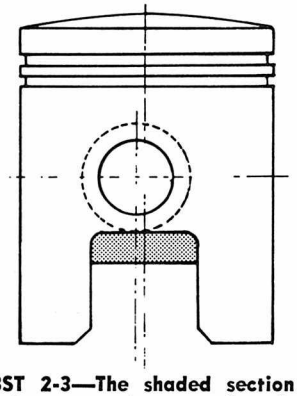


Fig. BST 2-3—The shaded section shown should be removed up to the piston pin boss. Be sure edges are rounded.

The tube should extend through the cover and inside surface must be smooth. The hole through the right side cover must be enlarged for the larger carburetor adapter tube. Refer to the Lubrication paragraph if oil injection pump is not reinstalled. Make certain that carburetor cover does not restrict air flow. It may be necessary to modify the carburetor cover to increase clearance.

LUBRICATION. When standard oil injection is used for racing, some additional oil should be mixed with fuel in tank. If the oil injection system is removed, oil to fuel ratio should be 1:15 or 1:20.

PISTON, CYLINDER AND HEAD. The piston reliefs shown in shaded section (Fig. BST 2-3) should be removed up to the bottom of piston pin boss. Be sure to round corners to prevent breakage. Cylinder head can be milled 0.8 MM (0.03 inch) to increase compression. When assembling, make certain that piston does not contact cylinder head.

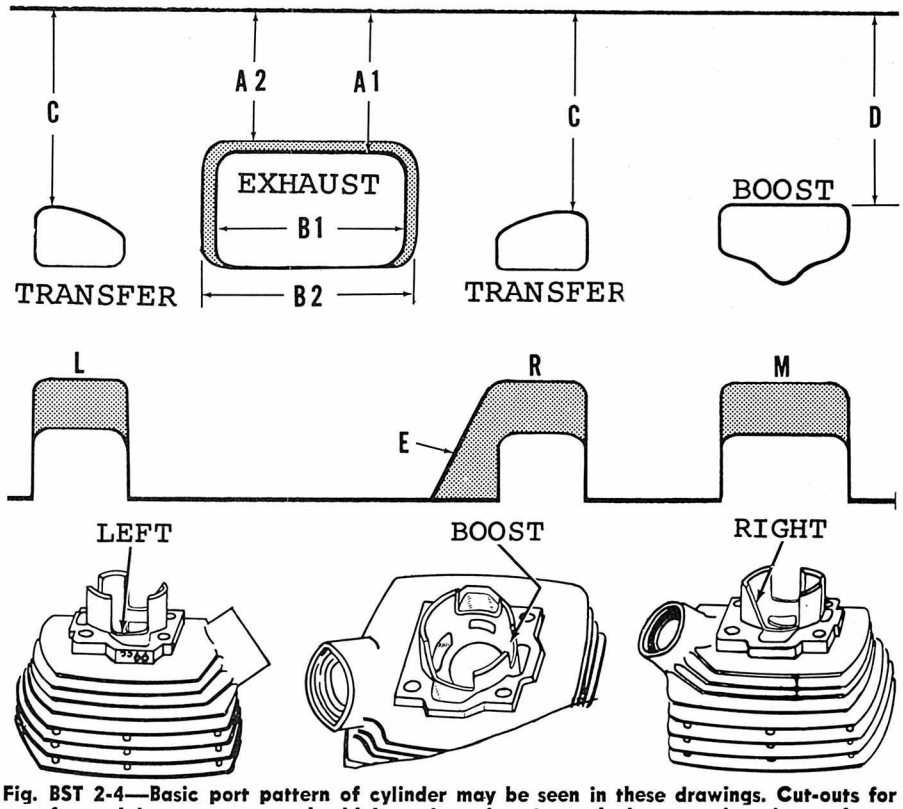


Fig. BST 2-4—Basic port pattern of cylinder may be seen in these drawings. Cut-outs for transfer and boost passages should be enlarged and matched to openings in crankcase to eliminate restrictions

The exhaust port in cylinder can be raised 1.5 MM and width can be increased 4 MM (2 MM each side). Original distance (A1—Fig. BST-4) to top of cylinder is 26.5 MM (1.04 inches); modified distance (A2) is 25 MM (0.984 inch). Original transfer port height (C) and shape should not be changed. Boost port height (D) and shape should not be changed. The height of transfer and boost passage cut-outs (L, M & R) should be raised and tapered (on outside) to provide less restriction. Edges of transfer passage cut-outs should be matched to crankcase openings. The forward edge (E) of the right transfer port opening will be angled slightly to match with crankcase opening. Refer to crankcase and rotary valve modifications before attempting to modify forward edge (E) of cylinder.

ROTARY VALVE, CRANKCASE AND CRANKSHAFT. The rotary valve and crankcase (inlet port) should be modified to begin inlet opening at 137.5 degrees Before TDC and inlet closing at 68 degrees After TDC. The manufacturer suggests the following method of changing the timing:

The rotary valve should be cut away 11.5 degrees on opening edge as shown at (C—Fig. BST 2-5). Carefully modify the valve, making certain that corners are rounded to prevent breakage at high rpm. Use the rotary valve and degree wheel to mark the right crankcase half for modification. The vertical center line used to measure angles (A & B—Fig. BST 2-6) is through the top and bottom rotary valve cover retaining screw holes as shown. Round all four corners of port opening to match the two corners of rotary valve. CAUTION: Do not raise the inlet port outside edge or rotary valve will not seal the port. After inlet port in right crankcase half is modified, the transfer passage cut out of cylinder (E—Fig. BST 2-4)

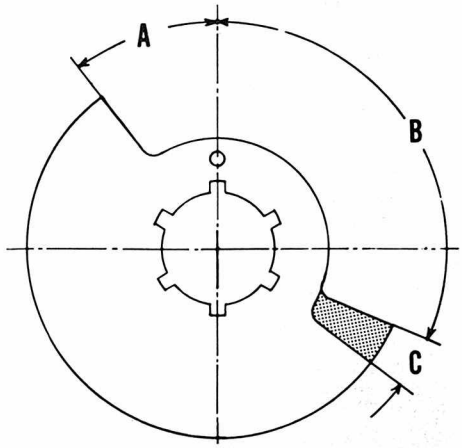


Fig. BST 2-5—Drawing of rotary valve showing shaded area to be removed from opening end. Angle (A) is 35 degrees, angle (B) is 115 degrees and angle (C) to be removed is 11.5 degrees.

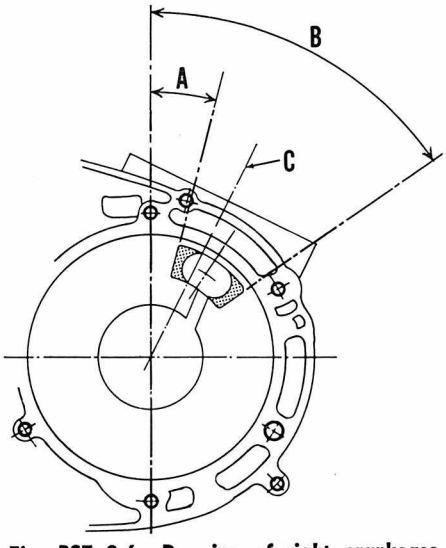


Fig. BST 2-6—Drawing of right crankcase half showing inlet port. Shaded area can be removed. New angle (A) is 14 degrees and new angle (B) is 58 degrees, measured from vertical center line. Refer to text. Center line of cylinder (C) is 25 degrees from vertical center line and is not the center of inlet port.

should be shaped to match crankcase opening.

NOTE: It may be desirable to provide the same inlet timing as previously listed by enlarging inlet port opening in right crankcase half to match opening in rotary valve cover, then cutting the rotary valve differently than shown in Fig. BST 2-5.

The crankshaft can be modified by filling the two balance holes and the crankpin with a suitable filler such as "DEVCON-F". Filling of these three holes will increase crankcase compression and will facilitate movement of the fuel-air mixture from the crankcase to the cylinder.

EXPANSION CHAMBER. Refer to Fig. BST 2-7 and the following specifications for constructing expansion chamber suggested by manufacturer.

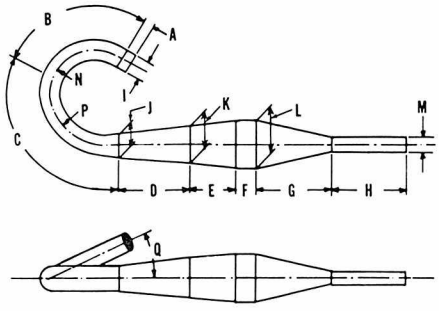


Fig. BST 2-7—Drawing of expansion chamber suggested. Refer to text for dimensions.

LENGTHS—
A. 25 MM
B. 120 MM
C. 155 MM
D. 140 MM
E. 80 MM
F. 35 MM
G. 140 MM
H. 135 MM

DIAMETERS—
I. 31 MM
J. 50 MM
K. 75 MM
L. 90 MM
M. 25 MM

RADIUS—
N. 80.5 MM
P. 105.5 MM

ANGLE—
Q. 24 Degrees

BRIDGESTONE 175 AND 200 CC

MODEL	175 Dual Twin	175 Hurricane Scrambler	MII SS	MII RS
Displacement-cc	177	177	198	198
Bore-MM	50	50	53	53
Stroke-MM	45	45	45	45
Number of cylinders	2	2	2	2
Oil-fuel ratio	Oil Pump	Oil Pump	Oil pump	Oil pump
Plug gap-inch	0.024-0.027	0.024-0.027	0.024-0.027	0.024-0.027
Point gap-inch	0.012-0.016	0.012-0.016	0.012-0.016	0.012-0.016
Ignition timing	Fixed	Fixed	Fixed	Fixed
Degrees BTDC	19-22	19-22	19-22	19-22
Electrical system voltage	12	12	12	12
Battery terminal grounded	Negative	Negative	Negative	Negative
Tire size-front	2.50 X 18	3.00x18		
Rear	2.75 X 18	3.00x18		
Tire pressure psi-front	24-26	24-26		
Rear	26-30	26-30		
Rear chain free play-inch	¾	¾	¾	¾
Number of speeds	5	5	5	5
Weight-lbs. (Approx.)	271	271	274	274

MAINTENANCE

SPARK PLUG. Recommended spark plugs for normal use are NGK type B-8H or Champion L-57R. For sustained high speed use NGK B-9HN or Champion L-54R. The plugs recommended for high speed may be too cold for starting and warm-up. Plug used for short track should usually be between the normal and cold plugs listed. Electrode gap should be 0.024-0.027 inch.

CARBURETORS. Two Mikuni VM type carburetors are used. Idle speed is adjusted at (2—Fig. BS3-1) after removing the carburetor top covers (rubber). Idle mixture is adjusted at needles (11) after removing carburetor side covers. Approximate setting for idle mixture needle (11) is 1½ turns open. Clip (5) should be installed in third groove from top of needle (6). Float level (H—Fig. BS3-2) should be 23/32 inch. Main jet standard size is 95 for 175 cc models; 90 for 200 cc models with standard carburetors. Normal size jet for the larger (22 MM) carburetors is 230 to 250 if used without air cleaners. If air cleaners are installed, a smaller main jet will be required (210-220).

Carburetors must be synchronized to begin opening both throttle slides (7—Fig. BS3-1) at the same time by adjusting cable guides (1) at top of each carburetor.

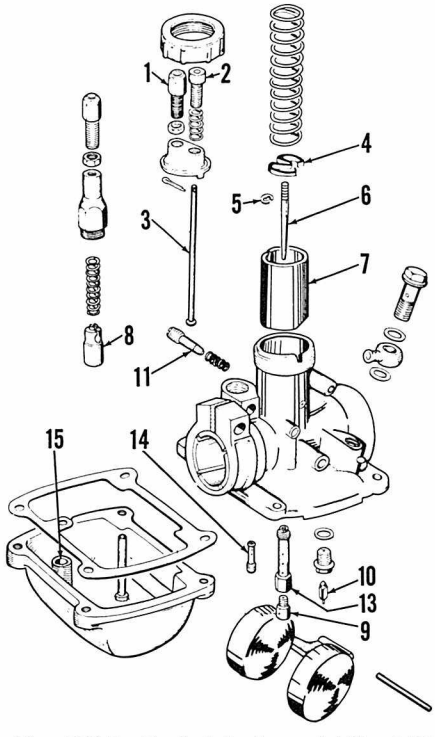


Fig. BS3-1—Exploded view of Mikuni VM type carburetor.

1. Throttle cable adjuster
2. Idle speed adjuster
3. Idle speed rod
4. Retainer
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Inlet valve
11. Idle mixture screw
13. Needle jet
14. Pilot jet
15. Starter jet

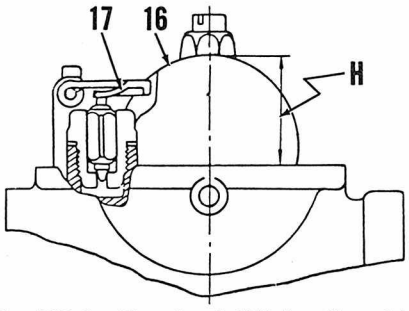


Fig. BS3-2—Float level (H) is adjusted by bending tang (17). Float bowl gasket should be removed when checking.

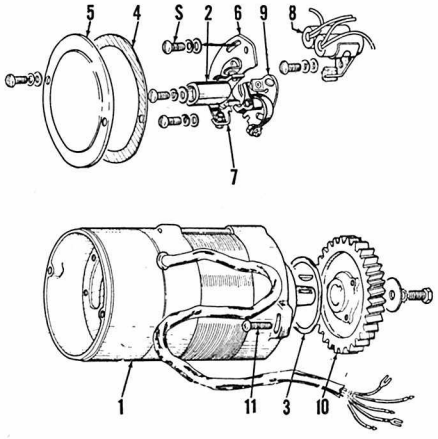


Fig. BS3-4 — Exploded view of early ignition timer. Alternator (1) is available only as a complete unit.

1. Alternator
2. Ignition point cam
3. O ring
4. Gasket
5. Cover
6. Breaker point base (left cylinder)
7. Breaker points (left cylinder)
8. Condensers
9. Breaker points (right cylinder)
10. Ignition timing gear
11. Lock screw

IGNITION AND ELECTRICAL. A battery type ignition system is used with alternator and ignition timer (points) assembly (Fig. BS3-4) mounted behind the cylinders. Maximum gap should be 0.012-0.016 in. for both ignition points (7 & 9) on all models.

Three types of ignition units and alternators have been used. Remove cover (5—Fig. BS3-4); then, refer to Fig. BS3-7 to determine type used. All models before serial number 16G-11761 have two lobes on ignition cam and gear (10—Fig. BS3-4) drives alternators at ½ crankshaft speed. Both later types are driven at same speed as crankshaft and the ignition breaker point cam has only one lobe. Refer to the appropriate following paragraphs for timing procedure, after determining type used.

Before Serial Number 16L-20758. To check ignition timing for both early types of ignition units, proceed as follows: Remove both spark plugs and the timing plug (P—Fig. BS3-5). Insert timing pin in timing plug hole and turn engine until points for right hand cylinder just open. At exact position where ignition points open, a hole in crankshaft counterweight should be aligned with timing plug hole (P—Fig. BS3-5). An additional hole in the crankshaft counterweight is provided for checking ignition timing for left cylinder.

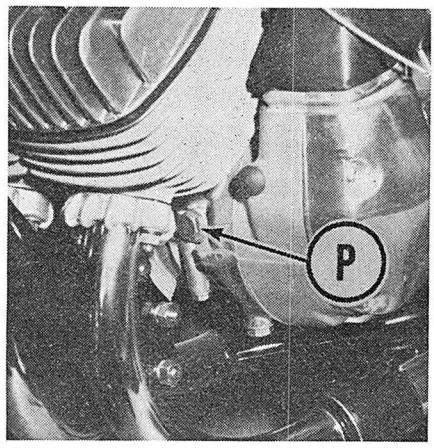


Fig. BS3-5—Ignition timing hole plug is at P.

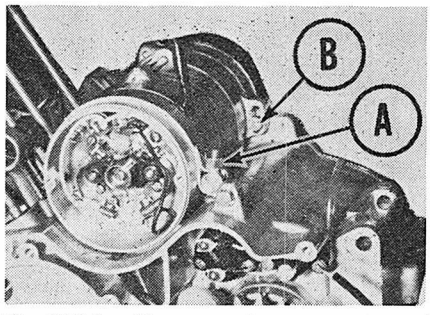


Fig. BS3-6—Alternator clamp nut (A) and lock screw (B) are accessible after removing air cleaner.

NOTE: Ignition timing must be correct for right cylinder before attempting to set timing for the left cylinder.

If ignition timing is wrong for the right hand cylinder with breaker point gap correctly set, proceed as follows. Remove the air cleaner and loosen clamp nut (A—Fig. BS3-6) and lock screw (B). With crankshaft correctly positioned rotate alternator assembly in the elongated hole until points for right cylinder (R—Fig. BS3-7) just open and tighten lock screw. Recheck timing after tightening lock screw and clamp nut.

If ignition timing for right cylinder is changed or if left cylinder timing is incorrect, proceed as follows. Rotate crankshaft until left cylinder timing hole in crankshaft is aligned with timing plug hole (P—Fig. BS3-5). The ignition points (L—Fig. BS3-7) are mounted on base (6—Fig. BS3-4) and can be rotated in the elongated holes after loosening the two base plate retaining screws (S). Recheck timing after tightening screws(S).

After Serial Number 16L-20757. To check the ignition timing on models with late type ignition unit, remove both spark plugs and the timing plug (P—Fig. BS3-5). Insert timing pin in timing plug hole and rotate crankshaft until points at rear (for right hand cylinder) just open. At exact position where ignition points just open, a hole in crankshaft counterweight should be aligned with timing plug hole. The additional hole in crankshaft counterweight is for timing left cylinder.

Ignition timing is adjusted by moving the breaker point base plate in the elongated mounting holes until timing is correct for one cylinder. Adjust breaker point gap for the other cylinder until points just open when timing pin enters the other hole in crankshaft counterweight. Maximum gap for both sets of breaker points must be within limits of 0.012-0.016 inch when timing is correct.

On All Models, the ignition and alternator is gear driven and must be correctly timed to the crankshaft as follows.

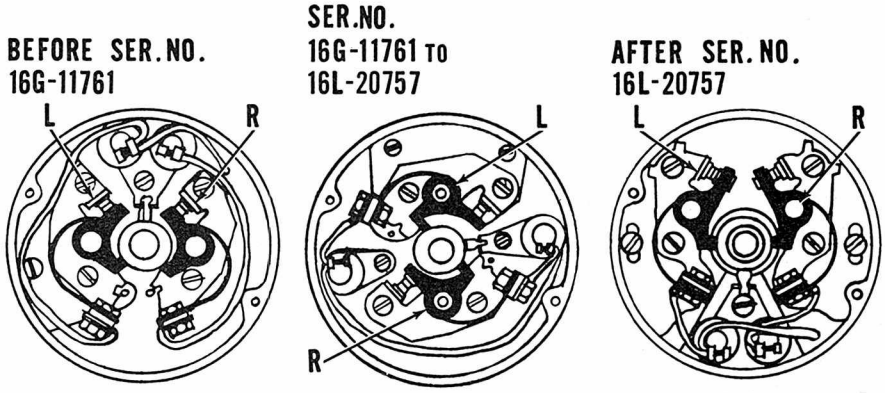


Fig. BS3-7—Three types of alternator and ignition units have been used as shown above. The earliest unit (left) is driven at ½ crankshaft speed and has two lobes on ignition cam. Later types (center and right) are driven at same speed as crankshaft and ignition cam has only one lobe. On all types, breaker points for left cylinder is shown at (L) and breaker points for right cylinder at (R).

On models before serial number 16G-11761 align punch mark on crankshaft spline with marked gear tooth as shown in Fig. BS3-8. Align marked crankshaft gear tooth and marked alternator gear tooth with the marks between gear teeth on clutch (primary drive) gear as show at (T—Fig. BS3-8A). NOTE: It may be necessary to rotate clutch gear several times to correctly align marks.

On models after serial number 16G-11760, align punch mark on crankshaft spline with marked gear tooth as shown in Fig. BS3-8. Align marked crankshaft gear tooth with mark between teeth on clutch (primary drive) gear as shown at (A—Fig. BS3-8B). The idler gear is not marked and can be installed in any position. Align marked tooth on alternator gear with center of idler gear as shown at (B). Incorrect assembly of gears will prevent correct external timing.

LUBRICATION. The engine is lubricated by an automatic oil injection system; however, for the first 250 miles, it **IS** necessary to add ½ pint of two stroke motor oil to each 1.25 gallons of gasoline (ratio 1 to 20). **AFTER** the first 250 miles, it is not necessary to add oil to the fuel.

On models before serial number 16G-117761, the engine oil pump drive gears are lubricated by a small amount of SAE 30 motor oil contained in the housing. Filling is accomplished after removing screw (F—Fig. BS3-9) using a pressure type oil can. Oil should be maintained at level of filler hole.

On later models, the pump drive gears are automatically lubricated by the transmission oil.

To adjust the oil metering system, turn the throttle hand control to the full open (fast) position and check clearance between control arm stop pin and control arm as shown in Fig. BS3-10. If clearance is not ⅛ inch, turn cable adjuster as necessary. Sometimes pressure in the pump will prevent control arm from returning to idle position until engine is running or rotated with starter.

NOTE: When servicing the oil injection pump, inspect the outlet connectors (CV-Fig. BS3-11). Earliest models are not equipped with check valves and newest type brass connectors (CV) should be installed. Some models use a loose ball and

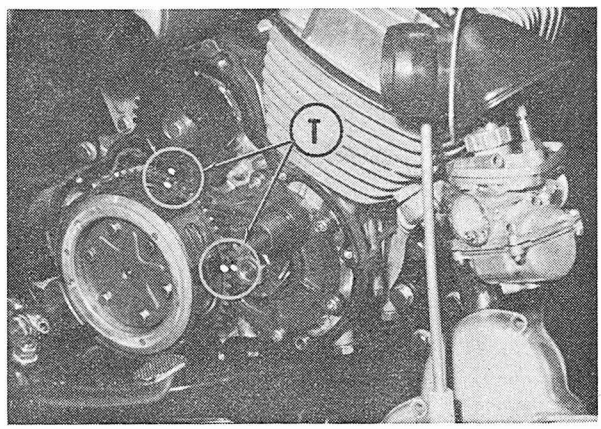


Fig. BS3-8A—View of ignition drive gear timing marks for early models (before Serial No. 16G-11761). Timing marks on clutch gear are at edge of clutch drum. It may be necessary to rotate clutch several times to align marks correctly.

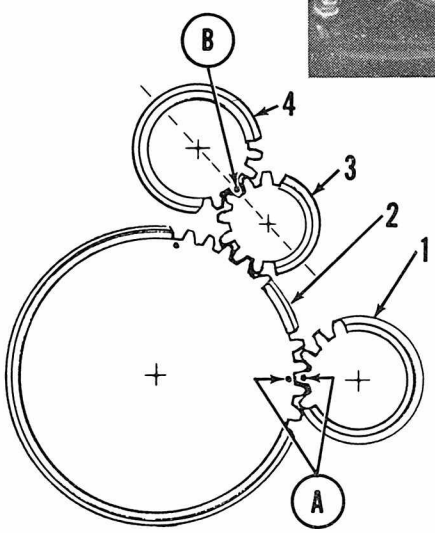


Fig. BS3-8B—Alternator on all models serial number 16G-11761 and later is driven at same speed as crankshaft. Refer to text for timing.

1. Crankshaft gear
2. Primary drive gear
3. Idler gear
4. Alternator gear

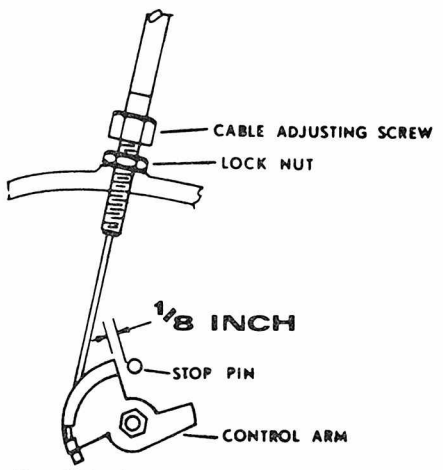


Fig. BS3-10—Automatic oil pump metering control arm should have 1/8 inch clearance with throttle fully open.

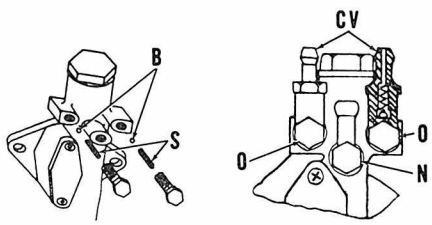


Fig. BS3-11—All pumps should be equipped with brass outlet check valve connectors (CV). Old style check valves (B & S) should be discarded. Inlet connector (N) must NOT have check valve.

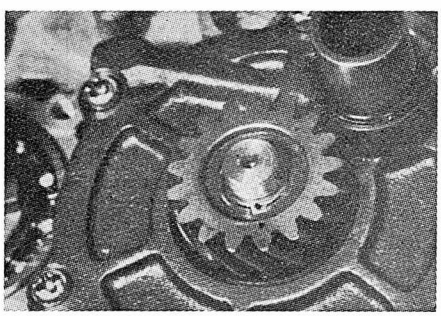


Fig. BS3-8—The marked tooth on the crankshaft gear must be aligned with marked spline as shown. Spline is not visible with nut installed.

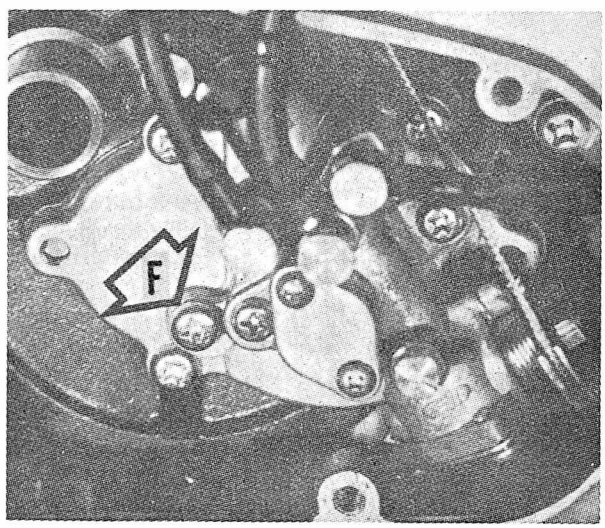
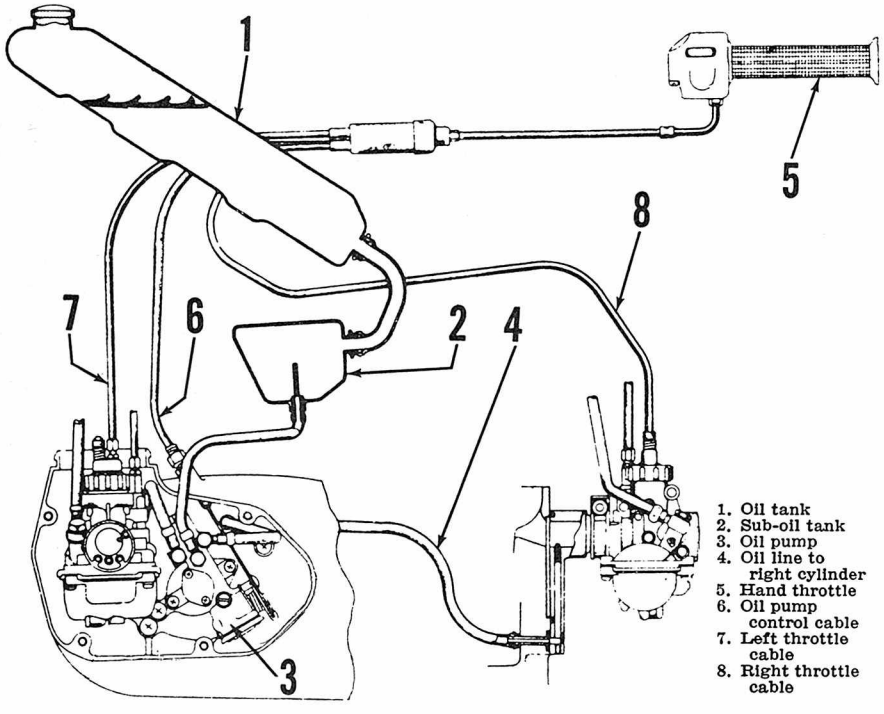


Fig. BS3-9 — On early models, oil pump drive gears must be lubricated. Refer to text.



1. Oil tank
2. Sub-oil tank
3. Oil pump
4. Oil line to right cylinder
5. Hand throttle
6. Oil pump control cable
7. Left throttle cable
8. Right throttle cable

Fig. BS3-12—Drawing of engine oil metering system. On early models (shown), the oil level sight gage is in sub-oil tank. On later models, oil tank is on right side.

spring in each outlet union bolt which should be discarded and the newest brass connectors (CV) should be installed. The brass connectors are equipped with check valves as shown in the cutaway view (Fig. BS3-11) and should be installed on **all** models.

If oil lines are allowed to drain, the pump should be primed by filling all lines with oil and operating kick starter several times with key turned off and throttle open.

The transmission contains (approx. 1 quart) of SAE10W/30 motor oil and should be maintained at level of plug (L—Fig. BS3-14).

CLUTCH CONTROLS. The clutch is located on right end of transmission input shaft. Hand lever should have ⅜-⅝ in. free play as shown at (B—Fig. BS3-15).

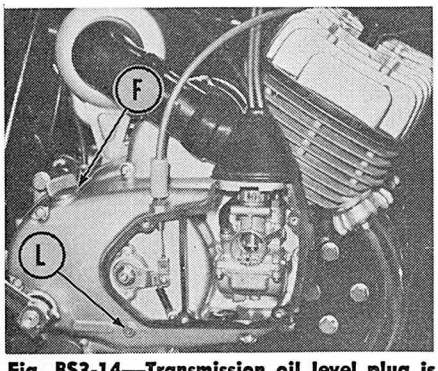


Fig. BS3-14—Transmission oil level plug is shown at L and filler plug at F. Clutch adjustment points are also shown. Refer to Fig. BS3-16.

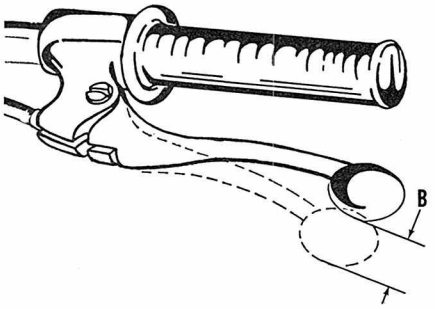


Fig. BS3-15—Clutch hand lever should have 3/8-5/8 inch free play at B.

To adjust clutch, remove the carburetor cover from right side of engine as shown in Fig. BS3-14. Loosen lock nut (4—Fig. BS3-16) and turn cable adjuster (3) until the distance between pivot pin (5) and spring pin (6) is 1¼ inches. Tighten lock nut (4) when distance is correct. Loosen nut (1) and turn the adjusting screw (2) until free play at end of hand lever is ⅜-⅝ inch. Make certain that nut (1) is tight after adjustment is complete.

SUSPENSION. Each front suspension unit contains 220 cc (7½ fl. oz.) of hydraulic jack oil. Refer to Fig. BS3-19 for exploded view. Fluid level should be 7½-8 inches from bottom of fork tube. Oil level can be measured using a long wire through the filler hole screw (1) in top fork brace. Complete rear suspension units should be renewed if bent, leaking or damaged.

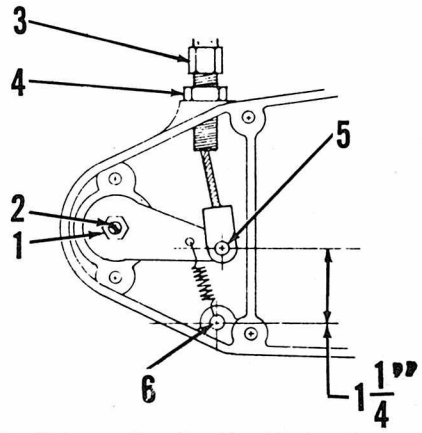
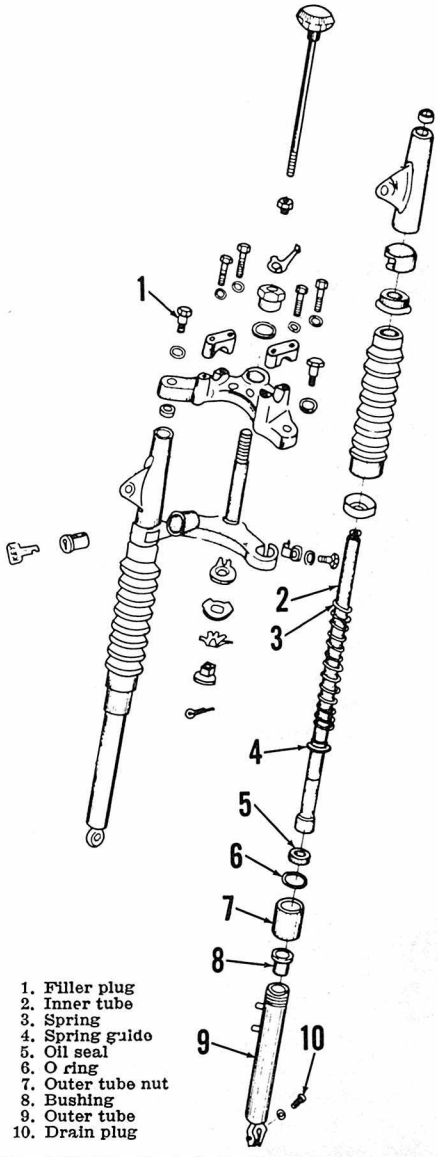


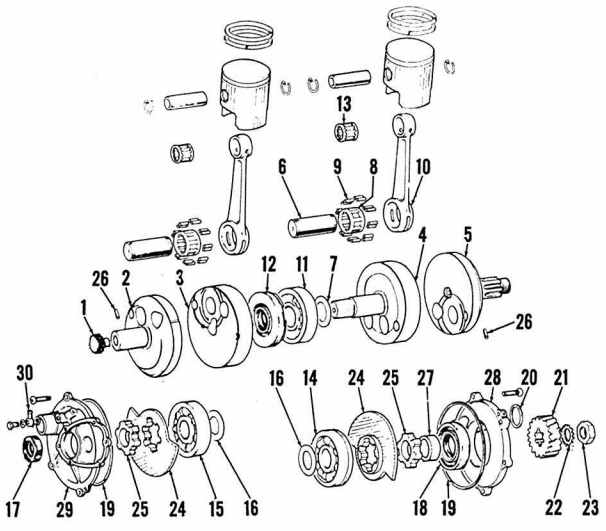
Fig. BS3-16—Clutch adjustment points are shown. Adjustment is usually accomplished at cable adjuster (4).

1. Lock nut
2. Adjusting screw
3. Lock nut
4. Cable adjuster
5. Pivot pin
6. Spring pin



1. Filler plug
2. Inner tube
3. Spring
4. Spring guide
5. Oil seal
6. O ring
7. Outer tube nut
8. Bushing
9. Outer tube
10. Drain plug

Fig. BS3-19—Exploded view of front suspension system.



1. Oil pump drive gear
2. Crankshaft left end
3. Left center counterweight
4. Right center counterweight
5. Crankshaft right end
6. Crankpin
7. Center bearing shims
8. Bearing cage
9. Crankpin rollers (16 each rod)
10. Connecting rod
11. Center main bearing
12. Seal
13. Piston pin bearing
14. Right main bearing
15. Left main bearing
16. Crankshaft shims
17. Left seal
18. Right seal
19. Valve cover 0 rings (2 used)
20. 0 ring (right side)
21. Crankshaft gear
23. Nut
24. Rotary valves
25. Splined collars
26. Collar drive pins (3X10 MM)
27. Seal collar
28. Right valve cover
29. Left valve cover
30. Oil line fitting

Fig. BS3-20—Exploded view of crankshaft assembly and rotary valves. Refer to Fig. BS3-24 for valve timing.

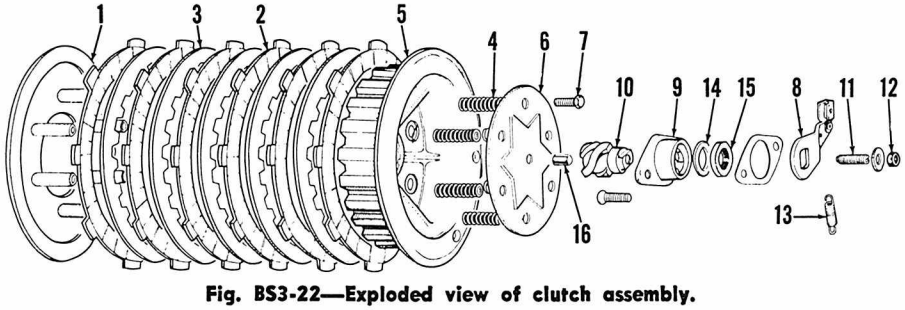


Fig. BS3-22—Exploded view of clutch assembly.

1. Pressure plate
2. Friction discs (6 used)
3. Driven plates (5 used)
4. Springs (6 used)
5. Hub
6. Cover plate
7. Cover plate screws
8. Release arm
9. Release threaded block
10. Release screw
11. Adjusting screw
12. Lock nut
13. Return spring
14. Washer
15. Oil seal
16. Roller (6X10 MM)

REPAIRS

PISTONS, RINGS AND CYLINDERS. Each piston can be removed after first removing the complete engine, cylinder head and cylinder. Diameter of chromium plated cylinder bores is 50.01 MM (1.969 in.) for 175 cc models; 53.00 MM (2.086 in.) for 200 cc models. Piston skirt to cylinder clearance should be 0.001-0.003 inch. The piston can be polished to obtain correct piston to cylinder clearance. NOTE: Do not hone chrome plated cylinder bores. Piston for 90 cc models with cast iron cylinder **MUST NOT** be used for 175 cc models. Correct pistons for use in chrome plated aluminum cylinders can be identified by a small flat spot in center of top. Pistons with small center hole in top of piston are for cast iron cylinders and should not be used. Oversize pistons and rings are not available

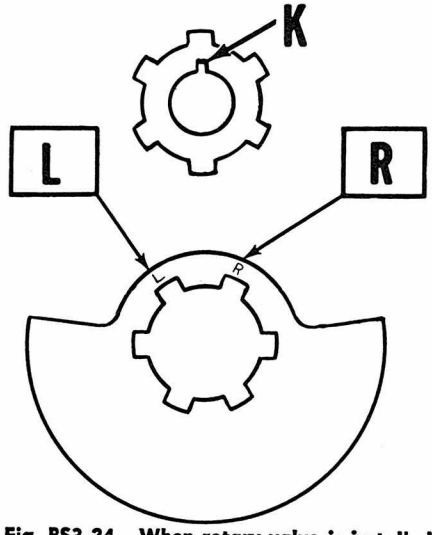


Fig. BS3-24—When rotary valve is installed on left side, L stamped on valve should be aligned with key slot (K) in splined collar. When used on right side, R stamped on valve should be aligned with key slot.

Piston ring end gap should be 0.006-0.020 inch. Ring side clearance in top groove should be 0.002-0.003 inch and 0.0012-0.0028 inch in bottom groove. If new piston ring has more than 0.006 inch side clearance in either groove, renew the piston. The rings for 90cc models with cast iron cylinder are chrome plated and **must not** be used in chrome plated cylinder bore of 175cc models.

When assembling piston, make certain the "EX" mark on piston is toward exhaust port. Ends of piston rings must be around pins in grooves when assembling cylinders. Cylinder head stud nuts should be torqued to 140 inch-pounds.

CONNECTING RODS AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Connecting rod side play (shake) at piston pin end should not exceed 0.125 in. If play at end of rod is excessive, crankpin, connecting rod and bearing should be renewed. The connecting rods are removed by pressing crankshaft apart. Crankshaft should be disassembled **ONLY** if required tools are available to correctly check and align the reassembled crankshaft.

When installing crankshaft, end play is adjusted by adding shims (16—Fig. BS3-20). End play should be 0.003-0.020 inch. Crankshaft gear (21) should be installed with timing mark on gear and spline aligned as shown in Fig. BS3-8. Crankshaft nut (23—Fig. BS3-20) is left hand thread and should be tightened to 250 inch pounds of torque.

The alternator and ignition timer are driven by the clutch (primary) drive gear and timing marks on crankshaft gear, clutch gear and alternator drive gear **MUST** be correctly aligned as described in previous IGNITION AND ELECTRICAL paragraph. Refer also to Fig. BS3-8A or BS3-8B.

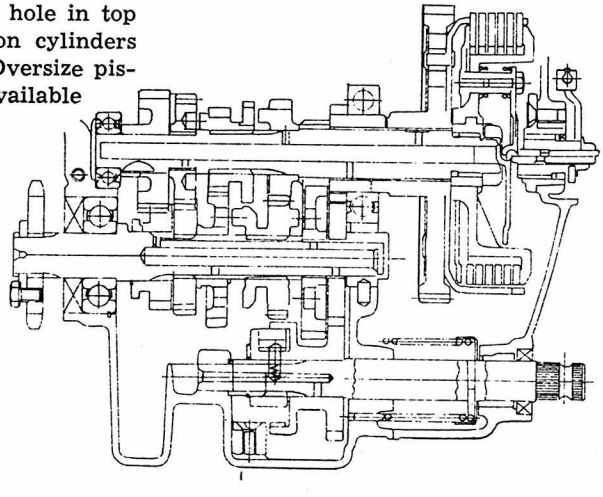


Fig. BS3-25 — Cross sectional view of transmission, clutch and kickstarter assembly.

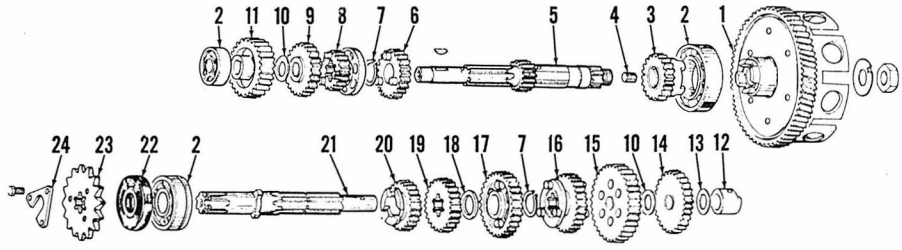


Fig. BS3-26—Exploded view of transmission gears and shafts. Clutch drum (1) is on right end of transmission input shaft (5).

1. Clutch drum
2. Ball bearings
3. Kickstarter gear
4. Rubber plug
5. Input shaft and first gear
6. Third gear
7. Snap rings
8. Second (sliding) gear
9. Fourth gear
10. Thrust washers
11. Fifth gear
12. Bushing
13. Thrust washer
14. Kickstarter gear
15. First gear
16. Third (sliding) gear
17. Second gear
18. Spacer
19. Fourth gear
20. Fifth (sliding) gear
21. Output shaft
22. Oil seal
23. Output sprocket
24. Sprocket retainer

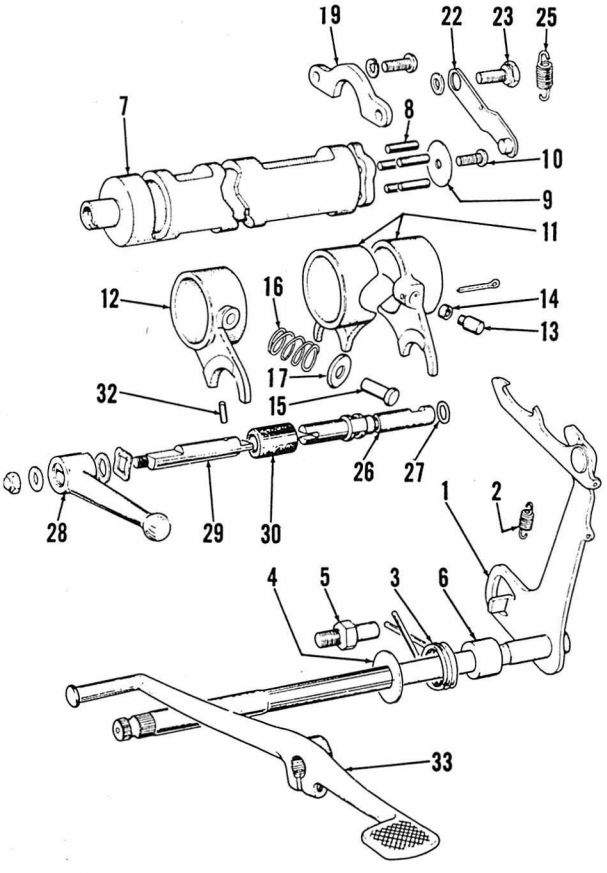


Fig. BS3-28 — Exploded view of gear selector mechanism. Shift forks (11) for the first four speeds are interchangable.

1. Gear selector arm and shaft
2. Selector arm spring
3. Pedal return spring
4. Spring retaining washer
5. Return spring pin
6. Spacer
7. Shift drum
8. Shift pins (5 used)
9. Retainer
11. Shift forks (First four speeds)
12. Fifth speed shift fork
13. Guide pins (2 used)
14. Roller (2 used)
15. Guide pin (Fifth speed fork)
16. Spring
17. Washer
19. Shift drum retainer
22. Shift drum stop
23. Pivot screw
25. Shift drum stop spring
26. Four or five speed cam
27. O ring
28. Four speed or five speed control handle
29. Extension shaft
30. Rubber
32. Coupling pin
33. Gear change pedal

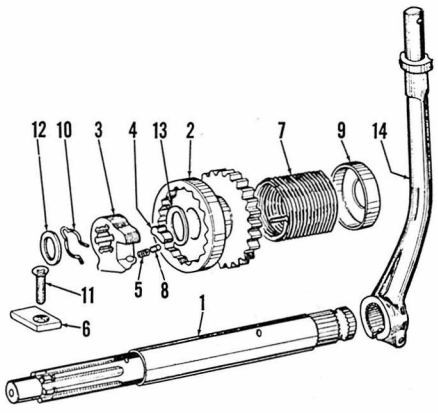


Fig. BS3-29—Exploded view of kickstarter assembly. Gear (2) engages gear (14—Fig. BS3-26).

1. Kickstarter shaft
2. Ratchet gear
3. Ratchet arm
4. Ratchet pawl
5. Spring
6. Stop
7. Return spring
8. Plunger
9. Spring cup
10. Snap ring
12. Thrust washer (12 MM)
13. Thrust washers (16 MM)
14. Kickstarter pedal

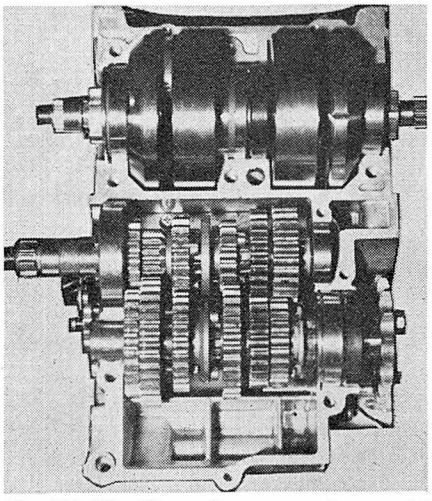


Fig. BS3-30—View of upper crankcase with transmission gears and crankshaft in position.

Refer to CRANKCASE AND GEAR BOX sections for installation of rotary valves.

CLUTCH. The multiple disc, wet type clutch is mounted on the right end of the transmission input shaft and can be removed after removing crankcase right side cover. Screws (7—Fig. BS3-22) should be tightened to 40 in. lbs. torque. The clutch retaining nut should be tightened to 130 in. lbs. torque. The release screw (10) can be installed in bracket (9) three different ways. When correctly installed, flats for release arm (8) will be horizontal, when end of screw (10) is flush with face of bracket (9). Make certain that release plunger (16) is correctly located in release screw before installing cover. Refer to previous paragraph in MAINTENANCE section for adjustment. Center of release arm pivot pin (5—Fig. BS3-16) should be 1¼ inches above center of spring pin (6).

CRANKCASE AND GEARBOX. The rotary valves (24—Fig. BS3-20) are located at each end of crankshaft. Valve on right side can be removed after removing carburetor, clutch, crankshaft gear (21), and valve cover plate (28). Valve on left side can be removed after removing carburetor, crankcase side cover, oil pump and and valve cover (29). Care should be taken to prevent valves from absorbing water or becoming too dry. After washing valve in solvent, be sure to wipe with oil to prevent complete drying out. Valves (24) are interchangable but valve must be correctly timed to spline collar (25) for correct side as shown in Fig. BS3-24.

The alternator and ignition timer are driven by the clutch (primary) drive gear and timing marks on crankshaft gear, clutch gear and alternator drive gear **MUST** be correctly aligned as described in preceding IGNITION AND ELECTRICAL paragraphs. Refer also to Figs. BS3-8, BS3-8A and BS3-8B.

Tighten the crankcase screws in the sequence cast in case next to the screws. The larger (8mm) screws should be tightened to 120 inch pounds torque; smaller screws (6mm) to 60 inch pounds torque.

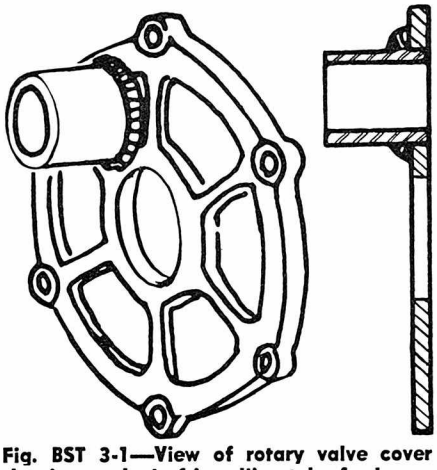


Fig. BST 3-1—View of rotary valve cover showing method of installing tube for larger carburetor. Outside diameter of tube must fit carburetor and inside diameter of tube should match carburetor bore.

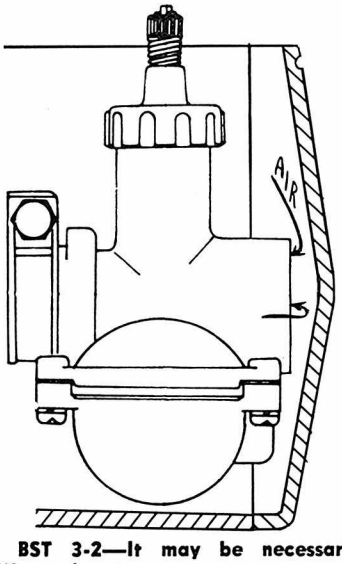


Fig. BST 3-2—It may be necessary to modify carburetor covers or space covers out to prevent restriction of air to carburetor.

SPEED TUNING

The following specifications are suggested by the manufacturer for increasing performance of 175 cc models. Some of the data may be useful for modifying 200 cc models. Any change from original configuration will probably decrease service life of an engine and, if changes are carelessly done, may decrease power and cause extensive damage. The specifications are for a guide only and will void warranty. With the following modifications, final drive sprocket ratio will probably need to be changed.

Road Racing (175 cc)

Horsepower and torque peak will occur at approximately 10,500 rpm.

SPARK PLUGS AND IGNITION. The coldest plug that can be used without excessive fouling should be installed. NGK type B-9HN or Champion L-54R spark plugs are suggested. The correct plug for racing application will probably be too cold for starting and warming up engine.

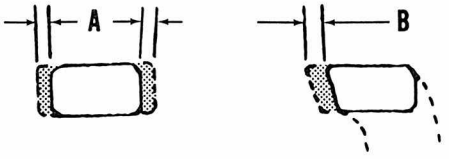


Fig. BST 3-3—The ports should not be raised. The exhaust port width can be increased 2 MM on each side (A) and the transfer port width can be increased 2 MM on exhaust port side. Maintain original port shapes.

Breaker point gap should be set at 0.25-0.30 MM (0.010-0.012 inch) for racing instead of standard gap. The ignition timing should be advanced to 24 degrees Before TDC instead of standard timing. The piston position at 24 degrees is 2.3 MM (0.090 inch) Before TDC. Timing holes in crankshaft **can not** be used for setting advanced timing. Make certain that timing is correct and the same for both cylinders.

CARBURETORS. Mikuni VM 22 or VM24SC carburetors should be adapted for use. Main jet size necessary for 22 MM carburetors will be approximately 230-250 and for 24 MM carburetors will be approximately 270-290. A suggested method of adapting the larger carburetors is to remove the carburetor adapter tube from rotary valve covers, then weld tubes in place as shown in Fig. BST 3-1. The tubes should extend through the cover and inside surface must be smooth. The hole through right side cover must be enlarged for the larger carburetor adapter tube. Refer to the Lubrication paragraph. Make certain that carburetor covers do not restrict air flow. It may be necessary to modify carburetor covers to increase clearance.

LUBRICATION. When the oil injection system is used for racing, some additional oil should be mixed with the fuel in tank. If the oil injection system is removed, oil to fuel ratio should be 1:15 or 1:20.

PISTONS, CYLINDERS AND HEADS. No modifications to the pistons are suggested. Cylinder heads can be milled 1.0-1.5 MM (0.04-0.06 inch) to increase compression. When assembling, make certain that pistons do not contact cylinder heads.

The exhaust port and transfer ports should be widened but **not** raised. The exhaust port width can be increased 4 MM (2 MM each side) and the transfer ports width can be increased 2-3 MM (on exhaust side). Refer to Fig. BST 3-3. Enlarge the boost port passage as shown in Fig. BST 3-3A. CAUTION: Do not change shape or size of boost port.

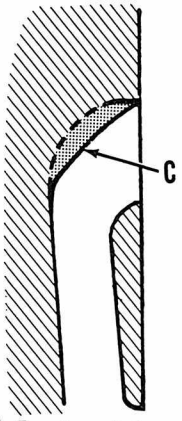


Fig. BST 3-3A—Boost port passage can be reshaped as shown to provide less restriction. Do not change boost port shape or size.

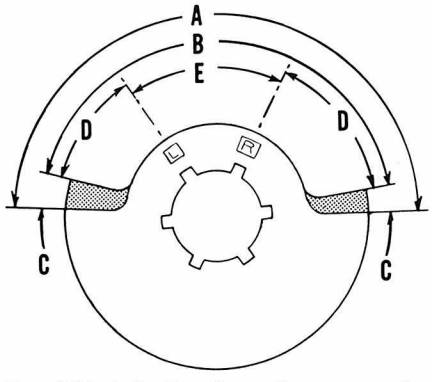


Fig. BST 3-4—Drawing of rotary valve showing suggested modifications.

A. 175 Degrees
B. Standard (155 Degrees
C. 10 Degrees
D. 40 Degrees

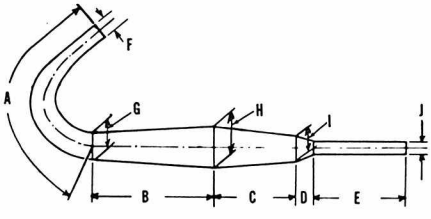


Fig. BST 3-5—Drawing of expansion chamber suggested for Road Racer 175 cc models. Refer to text for specifications.

ROTARY VALVES. The rotary valves should be cut away 10 degrees at both opening and closing ends as shown at (C—Fig. BST 3-4). Carefully modify the valves, making certain that corners are rounded to prevent breakage at high rpm.

EXPANSION CHAMBERS. Refer to Fig. BST 3-5 and the following specifications for construction of expansion chambers suggested by the manufacturer.

LENGTHS—	DIAMETERS—
A. 290 MM	F. 32 MM
B. 208 MM	G. 52 MM
C. 148 MM	H. 73 MM
D. 30 MM	I. 42 MM
E. 170 MM	J. 22.7 MM

Scrambler (175 cc)

Horsepower and torque peak will occur at approximately 7500 rpm.

SPARK PLUGS AND IGNITION. The coldest plug that can be used without excessive fouling should be installed. Plug readings should be carefully checked when selecting plug heat range. NGK type B-8HN or Champion L-57R plugs are suggested.

Breaker point gap should be set at 0.25-0.30 MM (0.010-0.012 inch) instead of the standard gap. Breaker points should just open at 24 degrees Before TDC. The piston position at 24 degrees is 2.3 MM (0.090 inch) Before TDC. Make certain that timing is correct and the same for both cylinders.

CARBURETOR. The standard carburetors will be satisfactory. The main jet size should be increased to approximately 100-110 with air cleaner installed or larger if air cleaner is removed. Special air cleaners are available which offer less restriction and are suggested by the U.S. Distributor.

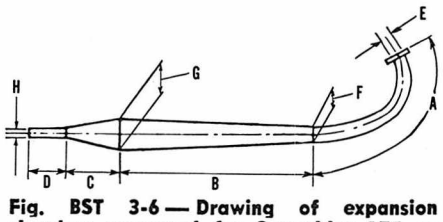


Fig. BST 3-6 — Drawing of expansion chamber suggested for Scrambler 175 cc models. Refer to text for specification.

LUBRICATION. When oil injection is used, some additional oil should be mixed with the fuel in tank. If oil injection pump is removed, oil to fuel ratio should be 1:15 or 1:20.

PISTONS, CYLINDERS AND HEADS. The pistons should not be modified. Cylinder heads can be milled 0.6-0.7 MM (0.02-0.03 inch) to increase compression. When assembling, make certain that pistons do not contact cylinder heads.

The ports in cylinders should not be changed. The only suggested change in passages is enlargement of the boost passage as shown in Fig. BST 3-3A.

ROTARY VALVES. The rotary valves should be cut away 10 degrees at both opening and closing ends as shown at (C—Fig. BST 3-4). Carefully modify the valves, making certain that corners are rounded to prevent breakage.

EXPANSION CHAMBER. Refer to Fig. BST 3-6 and the following specifications for constructing expansion chambers suggested by the manufacturer.

LENGTHS—	DIAMETERS—
A. 320 MM	E. 32 MM
B. 420 MM	F. 34 MM
C. 115 MM	G. 70 MM
D. 80 MM	H. 19 MM

BRIDGESTONE 350 CC

MODEL	350 GTO, 350 GTR
Displacement—cc	345
Bore—MM	61
Stroke—MM	59
Number of cylinders	2
Oil-fuel ratio	Oil Pump
Plug gap—inch	0.025-0.028
Point gap—inch	0.012-0.016
Ignition timing	Fixed
Degrees BTDC	23-26
Electrical system voltage	12
Battery terminal grounded	Negative
Tire size-front	3.25x19
Rear	3.25x19
Tire pressure psi—front	28-30
Rear	30-32
Rear chain free play—inch	⅜
Number of speeds	6
Weight—Lbs. (Approx.)	355

MAINTENANCE

SPARK PLUG. Recommended spark plugs for normal use are NGK type B-8H or Champion L-57R. For sustained high speed operation, a cold plug such as NGK type B-9HN or Champion L-54R can be used. Electrode gap should be 0.025-0.028 inch.

CARBURETORS. Two Mikuni VM 26SC carburetors are used. Idle speed is adjusted at (2—Fig. BS4-1) after removing the carburetor top covers (rubber). Idle mixture is adjusted at needles (11) after removing carburetor side covers. Approximate setting for idle mixture needle (11) is 2 turns open. Clip (5) should be installed in second groove from top of needle (6). Float level (H—Fig. BS4-2) should be 24MM ($\frac{15}{16}$-inch). When checking float level, make certain that spring in fuel inlet needle is not compressed and float bowl gasket should be removed. Standard size for main jet is 130. For break in, 140 main jets may be installed.

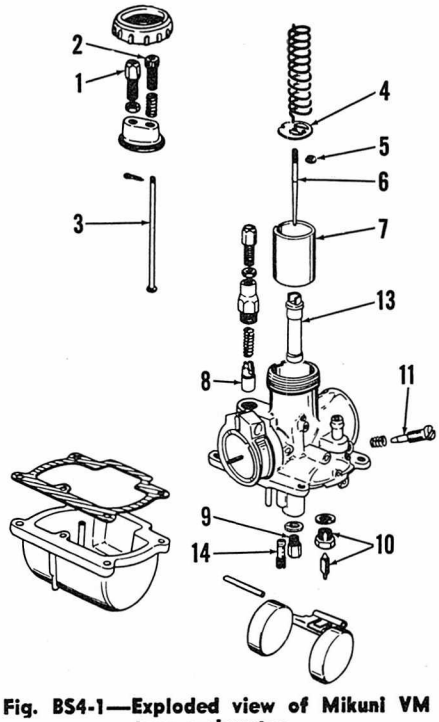


Fig. BS4-1—Exploded view of Mikuni VM type carburetor.

1. Throttle cable adjuster
2. Idle speed adjuster
3. Idle speed rod
4. Retainer
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Inlet valve
11. Idle mixture screw
13. Needle jet
14. Pilot jet

To adjust the carburetor throttle cables, turn the cable guides (1—Fig. BS4-1) until both cables have $\frac{1}{32}$-inch free play at idle. Twist the throttle toward fast position until the "O" mark on one of the throttle slides is at top of carburetor inlet bore. Check the "0" mark on other carburetor throttle slide and adjust cable guides (1) until both marks are exactly the same. Operate throttle several times then recheck to make sure adjustment is correct. After adjusting throttle cables, the oil injection pump controls should be checked.

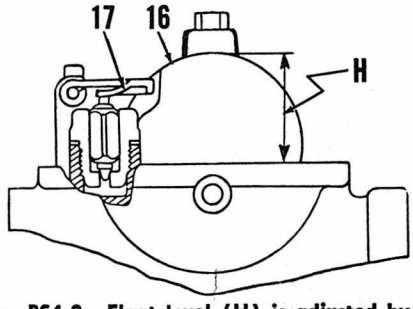


Fig. BS4-2—Float level (H) is adjusted by bending tang (17).

IGNITION AND ELECTRICAL. A battery type ignition system is used with alternator and ignition timer (points) assembly mounted behind the cylinders. Breaker point gap should be 0.012-0.016 in. for both sets of ignition points.

To check ignition timing, remove both spark plugs and timing plug (P—Fig. BS4-4). Insert timing pin in timing plug hole and turn engine until points at rear (for right hand cylin-

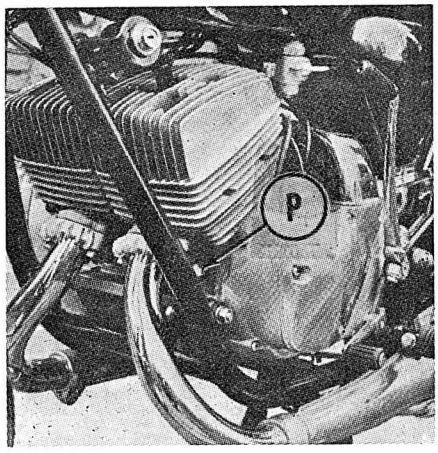


Fig. BS4-4—Ignition timing hole plug (P) is in the crankcase, behind the left exhaust pipe.

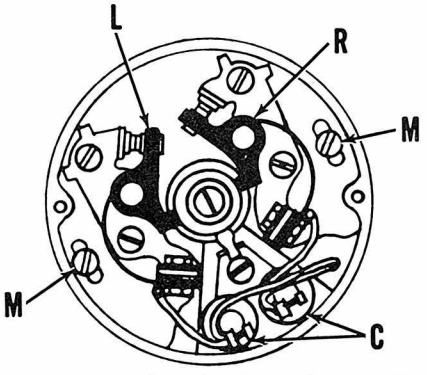


Fig. BS4-5—Ignition breaker point assembly (L) is for left cylinder, other points (R) are for right cylinder. The back plate assembly can be moved for timing after loosening the two mounting screws (M). Condensers are shown at (C).

der) just open. Piston should be 0.130 inch Before TDC, when timing pin holes are aligned. At exact position where ignition points open, a hole in crankshaft counterweight should be aligned with timing plug hole. An additional hole in the crankshaft counterweight is provided for checking ignition timing for left cylinder.

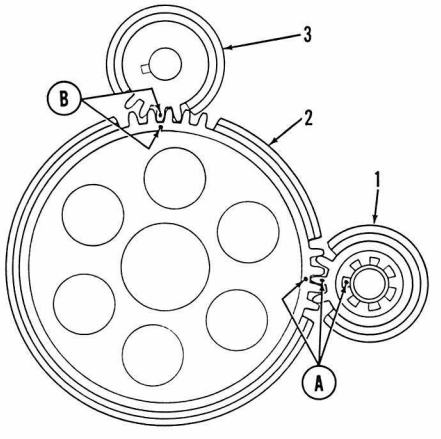


Fig. BS4-6—The crankshaft gear (1) must be installed on crankshaft splines with timing marks aligned. The three marks (A) on crankshaft, gear (1) and primary drive gear (2) should all be aligned when mark on alternator drive gear (3) is aligned with top mark on primary drive gear (2) as shown at (B).

Ignition timing is adjusted by moving the breaker point base plate in the elongated mounting holes until timing is correct for one cylinder. Adjust the breaker point gap for the other cylinder until points just open when the timing pin enters the other hole in crankshaft. Maximum gap for both sets of breaker points must be within limits of 0.012-0.016 inch when timing is correct.

The alternator and ignition timer is driven by the clutch (primary drive) gear at same speed as crankshaft. If the timing marks on crankshaft splines, crankshaft gear, primary drive gear (two marks) and alternator drive gear are not correctly aligned, it will be impossible to adjust the ignition timing. Refer to Fig. BS4-6 for location of timing marks on gears and crankshaft. It is necessary to remove the carburetor, clutch and gear cover from the right side of engine before timing marks (A & B—Fig. BS4-6) can be viewed. The nut must be removed from crankshaft before mark on spline can be seen.

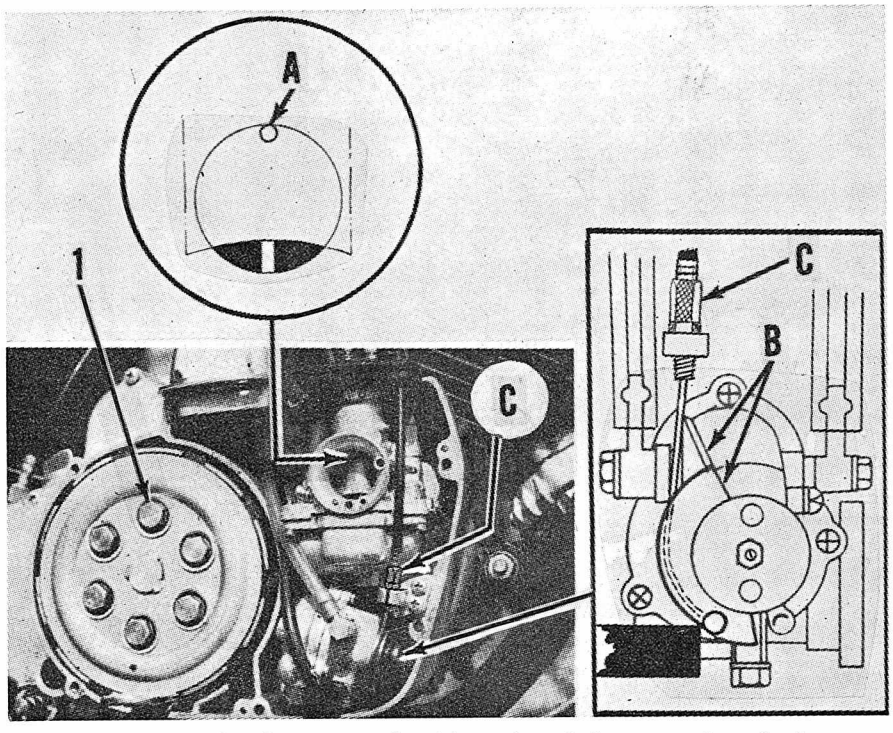


Fig. BS4-7—View of the oil pump synchronizing points. Refer to text for adjusting pump control cable.

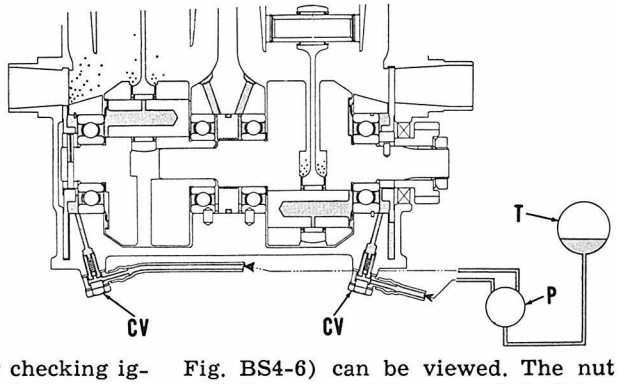


Fig. BS4-8 — Drawing of oil injection system. Check valves (CV) are part of the union bolts that attach oil lines to crankcase. Oil flows from tank (T) to pump (P) where it is metered and pressurized.

LUBRICATION. The engine is lubricated by an automatic oil injection system. Refer to Fig. BS4-8 schematic drawing. The oil is metered and pressurized in the pump unit shown in Fig. BS4-9. The oil pump is driven by worm (W) which turns gear (G). The back of gear (G) is provided with a ramp which contacts rod (R). As the gear (G) turns, spring (S) pushes the gear ramp against rod (R). The pump plunger is an integral part of gear and also moves back and forth, pumping the oil. Distributor (D) is driven by a gear on pump shaft and times the opening and closing of pump outlet ports. The control lever (L) is turned by a cable from the throttle grip. A cam on the back of control lever pushes rod (R), at large throttle openings, which causes gear (G) to move farther and pump more oil.

The oil pump cable should be sychronized to the carburetor throttle

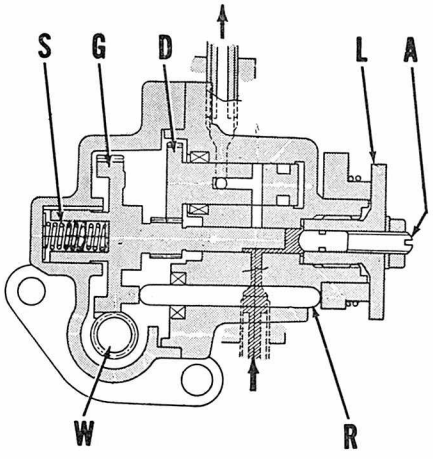


Fig. BS4-9—Cross sectional drawing of oil pump. The distributor (D) must be timed to gear (G) if pump is disassembled. Refer to text.

opening to provide correct amount of oil for the engine speed. Open throttle until the "0" mark on the throttle slide is aligned with top of choke bore as shown at (A—Fig. BS4-7). With the carburetor throttle open to exactly this position, the edge of the pump control lever should be aligned with the projection on pump as shown at (B). If marks on pump and on carburetor are not both aligned, turn the cable adjuster (C) as required until the pump is correctly sychronized to the carburetor throttle opening. Make certain that cable adjuster lock nut is tightened after adjustment is complete.

NOTE: Individual parts of the oil pump are not available; however, if the pump is disassembled, the distributor (D—Fig. BS4-10) must be timed to gear (G). Insert distributor into pump bore and align the timing mark (TM) on distributor gear with center of the pump plunger bore as shown at (X). Make certain that distributor does not move and install the gear (G) with the steep edge (E) of ramp in the center of distributor as shown at (Z). Reassemble spring (S—Fig. BS4-9) and worm gear (W) and housing. Only internal timing of the distributor is necessary. Pump assembly does not need to be timed to engine. The pump adjusting screw (A) controls pump volume and should not be changed unless accurate test equipment is available. Minimum plunger stroke should be 0.40-0.45MM (0.016-0.018 in.) and should provide 60 to 68cc/hour at 5,000 engine rpm. Maximum plunger stroke should be 3.6-3.73MM (0.152-0.147 in.) and should provide 600 to 626cc/hour at 5,000 engine rpm. Oil consumption should be approximately 1 quart every 400 miles.

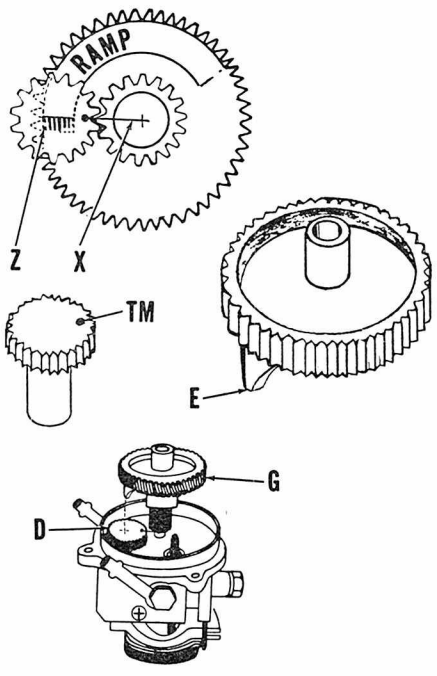


Fig. BS4-10—If the pump is disassembled, the distributor (D) must be timed to the pump gear (G). Refer to text.

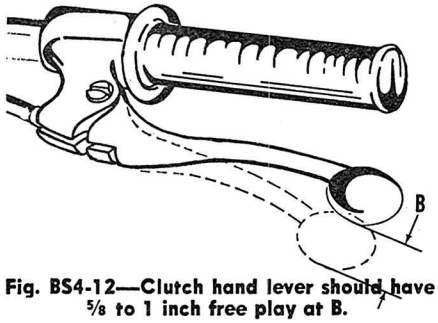


Fig. BS4-12—Clutch hand lever should have 5/8 to 1 inch free play at B.

The pump can be primed by starting engine and running at idle speed, then turning pump control lever (without moving throttle) to the maximum position. Pump and lines are primed when both exhausts smoke excessively. Make certain that pump control cable enters groove in lever when lever is released.

CLUTCH CONTROLS. The clutch is located on right hand end of transmission input shaft. Hand lever should have 5/8 to 1 inch free play as shown at (B—Fig. BS 4-12). Adjustment is normally accomplished at cable adjuster on hand lever. Additional adjustment can be accomplished at screw (Fig. BS4-13) under the rubber plug on left side of engine. Make certain that locknut is tight after adjusting.

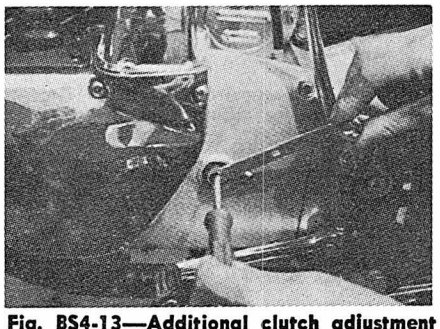


Fig. BS4-13—Additional clutch adjustment is accomplished as shown on left side.

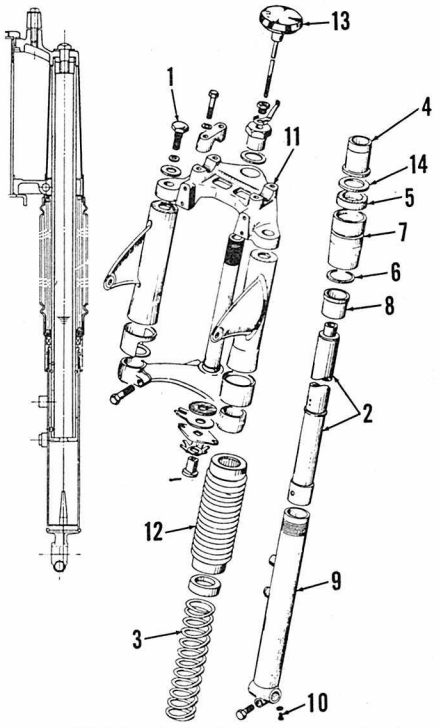


Fig. BS4-15—Exploded view of the front suspension. Cross section is at left.

1. Filler plug
2. Inner tube
3. Spring
4. Spring guide
5. Oil seal
6. "O" ring
7. Outer tube nut
8. Bushing
9. Outer tube
10. Drain plug
11. Top fork brace
12. Dust cover
13. Steering friction knob
14. Dust seal

SUSPENSION. Each front suspension unit contains 220cc of fork oil. The oil level should be 8 inches from the bottom of each fork tube. Oil is filled and measured through hole for plug (1—Fig. BS4-15). Drain plug is shown at (10). When dust covers (12) are installed, the small air holes should be toward outside and rear.

Rear suspension units can be adjusted by relocating the top mounting position as shown in Fig. BS4-16. With shock absorber in near vertical posi-

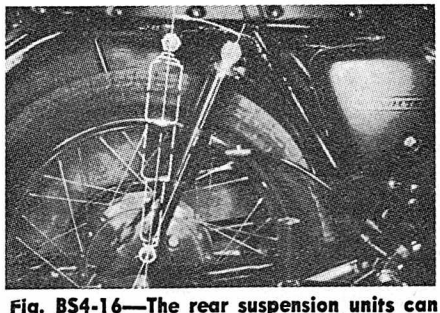


Fig. BS4-16—The rear suspension units can be adjusted by relocating top mounting. Front location is normal, rear position is firm.

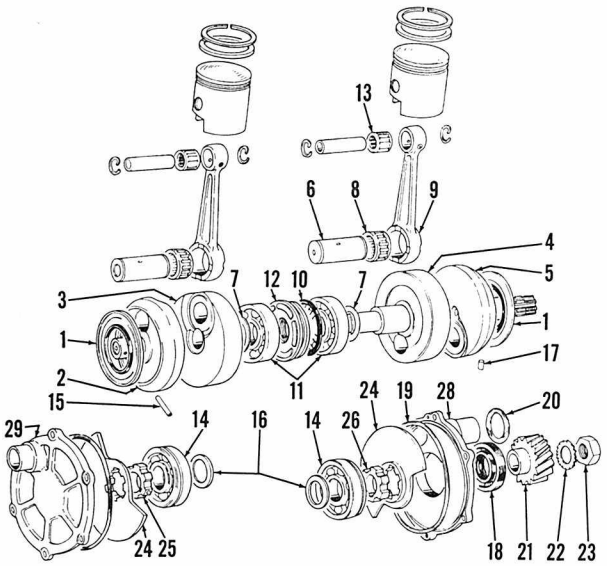


Fig. BS4-18—Exploded view of crankshaft assembly and rotary valves. Refer to Fig. BS4-23 for valve timing. Seals (1) should not be installed. Refer to text.

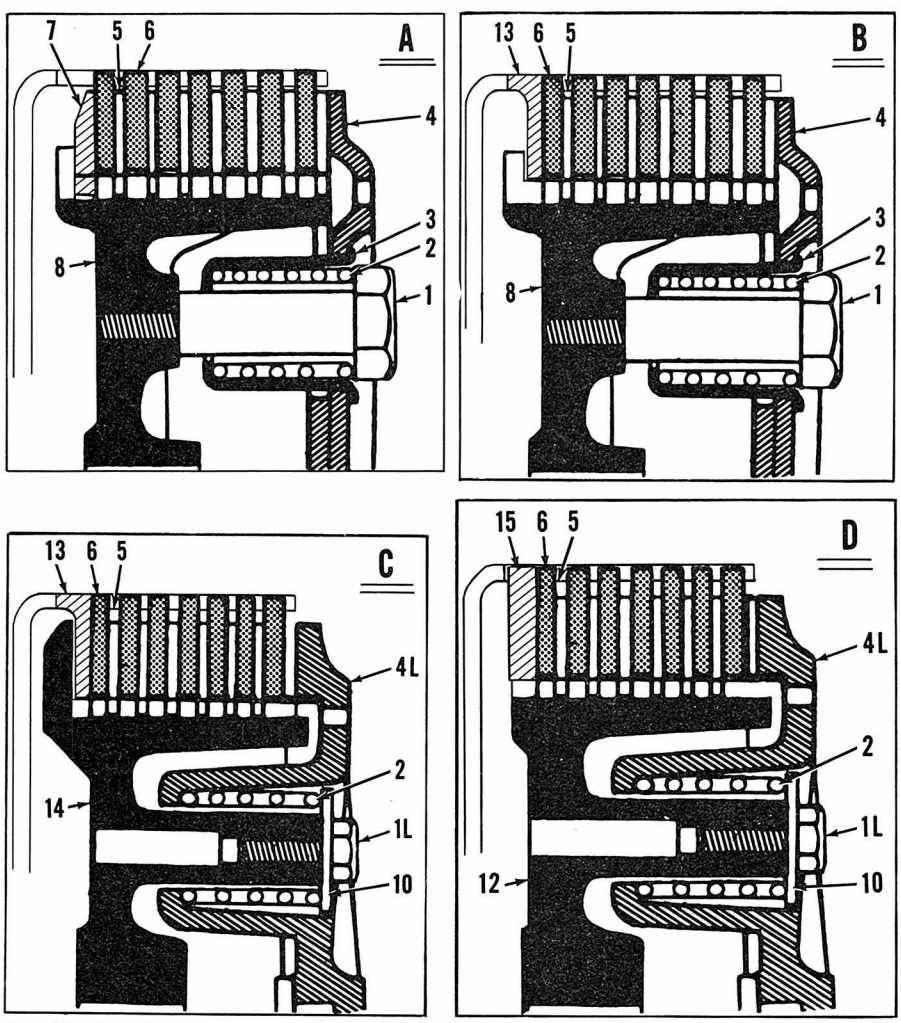


Fig. BS4-20—Cross section of clutch assemblies used. Type "A" is early, unmodified type. Type "B" is early type with modification. Type "C" is later type used on some models. Type "D" is view of latest style clutch.

1. Early screws (6 used)
1L. Late screws (6 used)
2. Springs (6 used)
3. Early Spring cups (6 used)
4. Early pressure plate
4L. Late pressure plate
5. Driven plates
6. Friction discs
7. Early outer plate
8. Early hub
10. Late washer
12. Clutch hub (late models)
13. Outer plate (some models)
14. Clutch hub (some models)
15. Outer plate (late models)

tion, ride is firm. Normal position is on forward mounting bolt. Both should be at same setting. If the rear suspension units are bent, leaking or otherwise damaged, units should be renewed. Service parts are not available.

REPAIR

PISTONS, RINGS AND CYLINDERS. Pistons can be removed without removing engine from frame after removing seat, fuel tank, horn, ignition coils, cylinder heads and cylinders. Diameter of chrominum plated aluminum cylinder bores should be 61.005-61.025MM (2.4018-2.4026 in.). If diameter at any point exceeds 61.1MM (2.4055-in.) cylinder should be renewed. Piston to cylinder clearance should be 0.04-0.05MM (0.0016-0.0019 in.). The piston can be polished to obtain correct clearance, but do not hone chrome plated cylinder bores. Oversize piston and rings are not available. If piston to cylinder clearance exceeds 0.15MM (0.0059 in.), renew piston and/or cylinder. Piston ring end gap should be 0.15-0.35MM (0.0059-0.0138 in.). Wear limit is 1.0MM (0.04 in.).

When assembling piston, make certain that "EX" mark on top of piston is toward exhaust port. Ends of piston rings must be around pins in grooves before installing cylinders. Cylinder studs should be tightened in crankcase to 304-345 inch pounds torque. Cylinder head nuts should be torqued to 217-260 inch pounds.

CONNECTING RODS AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Connecting rod side play at piston pin end should not exceed 0.1654 inch. If play at end of rod is excessive, crankpin, connecting rod and bearing should be renewed. The connecting rods are removed by pressing crankshaft apart. Crankshaft should be disassembled ONLY if required tools are available to correctly check and align the reassembled crankshaft.

NOTE: Oil seals (1—Fig. BS4-18) are no longer used and should be removed if installed. Seals (1) can be cut off without removing main bearings, if carefully done.

When installing crankshaft, refer to Fig. BS4-8. Make certain that bearing dowels and retainer rings are correctly positioned. Crankshaft gear retaining nut (23—Fig. BS4-18) is left hand thread and should be tightened to 65-72 Ft.-Lbs. torque.

Refer to CRANKCASE AND GEAR BOX sections for installation of rotary valves.

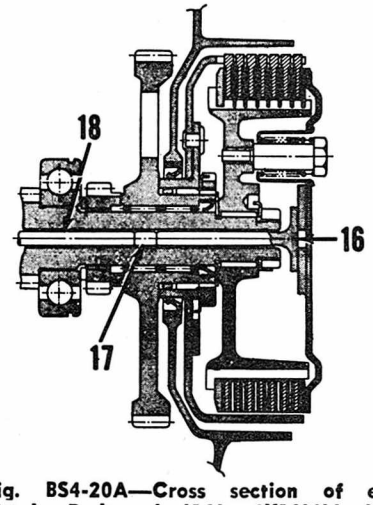
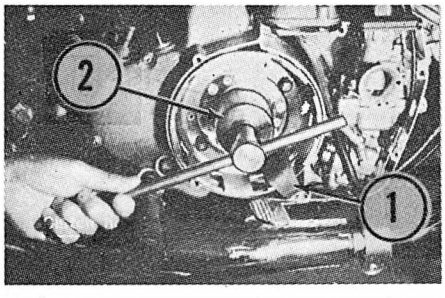


Fig. BS4-20A—Cross section of early clutch. Push rod (16), 6X10MM dowel (17) and release rod (18) are the same on all models.

The alternator and ignition timer are driven by the clutch (primary drive) gear and timing marks on crankshaft splines, crankshaft gear, clutch gear and alternator drive gear MUST be correctly aligned as shown in Fig. BS4-6.

CLUTCH. The multiple disc, dry clutch is located on the right end of the transmission input shaft and must be removed before removing the crankcase right side cover. Remove the carburetor cover from right side and remove all six screws (1—Fig. BS4-7). NOTE: Remove screws (1) evenly to prevent distortion of plates. After screws are removed, springs, cups, pressure plate, friction discs and driven plated can be withdrawn. Specifications for springs, friction discs and driven plates are as follows.



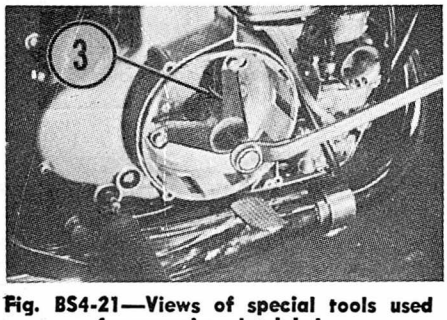


Fig. BS4-21—Views of special tools used for removing clutch hub.

1. Clutch drum holder
2. Ring nut wrench
3. Clutch drum puller

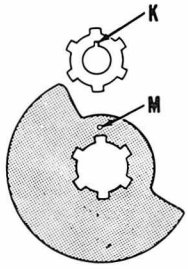


Fig. BS4-23—Mark (M) on rotary valves should be aligned with keyway (K) on the drive collars.

Springs (2—Fig. BS4-20)—
Free length .....1.191-1.214 in.
Wear limit .....1.140 in.
Friction discs (6)
Thickness .....0.116-0.118 in.
Drive lug width .....0.581 in.
Distortion (warpage)
limit .....0.0039 in.
Driven plates (5, 7, 13 & 15)
Distortion (warpage)
limit .....0.0078 in.

The clutch hub (8, 14 or 16) can be withdrawn after nut is removed. Special 40MM ring nut wrench and clutch drum puller should be used to remove the clutch drum as shown in Fig. BS4-21.

The ring nut wrench and puller are contained in the special tool set (part number 9300-9010). The cover can be removed from right side of engine after clutch drum is withdrawn, carburetor is removed and oil lines are disconnected. NOTE: Disconnect oil lines from pump.

When reassembling, tighten the 40MM ring nut with special wrench (2—Fig. BS4-21) to 29-36 Ft.-Lbs. torque. The clutch hub retaining nut should also be torqued to 29-36 Ft.-Lbs. On early type clutch, install the thickest (outer) plate (7, 13 or 15—Fig. BS4-20) with flat side toward friction disc. Install pressure plate (4 or 4L) with mark on pressure plate aligned with timing mark on end of

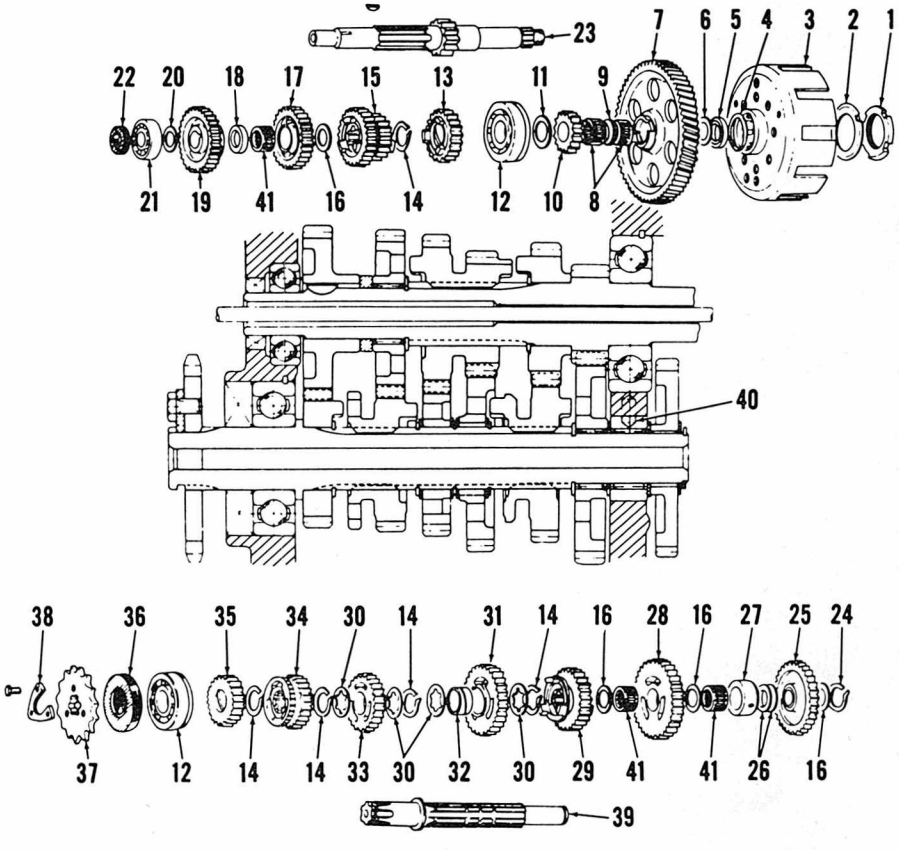


Fig. BS4-25—Cross sectional and exploded views of transmission input shaft (23), output shaft (39) and associated parts. Dowel (40) holds bearing outer race (27) in lower crankcase half.

1. Ring nut
2. Lock washer
3. Clutch drum
4. "O" ring (35MM)
5. Oil seal
6. Thrust washer (22MM)
7. Primary drive gear
8. Needle bearings
9. Spacer
10. Kick starter gear
11. Thrust washer (22MM
12. Ball bearings
13. Gear (3rd)
14. Snap rings
15. Sliding gear (2nd & 4th)
16. Thrust washer (20MM)
17. Gear (5th)
18. Spacer
19. Gear (6th)
20. Thrust washer (17MM)
21. Ball bearing
22. Oil seal
23. Input shaft
24. Snap ring
25. Kick starter gear
26. Shims (20x0.3MM)
27. Outer race
28. Gear (1st)
29. Sliding gear (3rd)
30. Thrust washer (25MM)
31. Gear (2nd)
32. Bushing
33. Gear (4th)
34. Sliding gear (5th)
35. Gear (6th)
36. Oil seal
37. Output sprocket
38. Sprocket retainer
39. Output shaft
40. Dowel pin (6x10MM)
41. Needle bearings

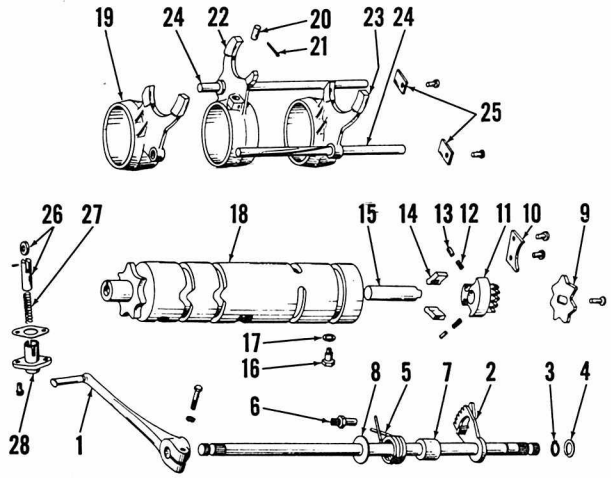


Fig. BS4-26—Exploded view of gear selector mechanism. Shift forks (19, 22 & 23) are interchangeable.

1. Shift lever
2. Change shaft and arm
3. Snap ring
4. Thrust washer
5. Return spring
6. Stop pin
7. Spacer
8. Spring seat
9. Stop plate
10. Guide plate
11. Drum shifter
12. Spring (2 used)
13. Plunger (2 used)
14. Ratchet pawl (2 used)
15. Shaft
16. Guide pin
17. Aluminum seal
18. Shift drum
19. Shift fork (4th & 6th)
20. Guide pin (3 used)
21. Cotter pin (3 used)
22. Shift fork (3rd & 5th)
23. Shift fork (1st & 2nd)
24. Fork guide rails
25. Guide rail retainer plates
26. Detent
27. Spring
28. Detent housing

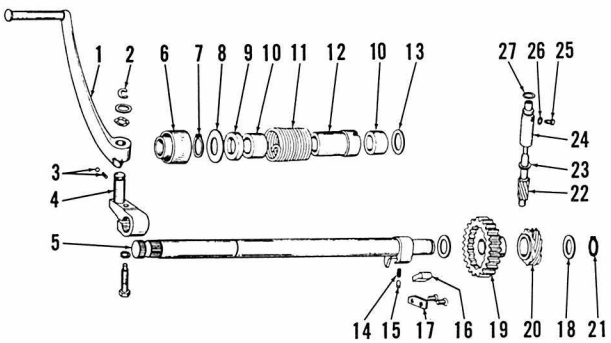


Fig. BS4-27 — Exploded view of kick starter assembly. When starting, pawl (16) engages gear (19). When starter is released, stop (17) holds pawl (16) away from gear (19). Kick starter gear (19) turns crankshaft via gears (25, 10 & 7—Fig. BS4-25).

1. Folding pedal
2. Snap ring
3. Pedal detent
4. Pedal shaft
5. Starter shaft
6. Chain guide
7. Snap ring
8. Washer
9. Oil seal
10. Bushings
11. Return spring
12. Spring spacer
13. Thrust washer (18MM)
14. Pawl spring
15. Plunger
16. Ratchet pawl
17. Pawl stop
18. Thrust washer (15MM)
19. Kickstarter ratchet gear
20. Tachometer gear
21. Snap ring
22. Tachometer gear
23. Thrust washer (8 MM)
24. Bushing
25. Bushing lock screw
26. Fiber washer
27. O ring

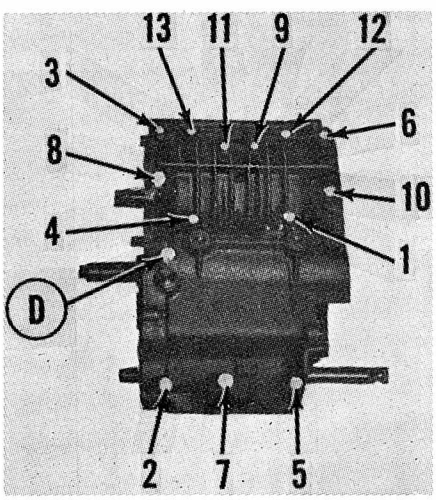


Fig. BS4-28—Tighten the screws in lower crankcase in the order shown. Screw sizes are listed below. Shift drum guide plug is shown at (D).

1. 8 x 90 MM
2. 8 x 62 MM
3. 8 x 90 MM
4. 6 x 90 MM
5. 6 x 62 MM
6. 8 x 90 MM
7. 8 x 62 MM
8. 8 x 114 MM
9. 6 x 62 MM
10. 8 x 100 MM
11. 6 x 62 MM
12. 6 x 62 MM
13. 6 x 62 MM

clutch hub. On early type clutch shown in views ("A" and "B"), the special screws (1) should be tightened to 130-174 inch pounds torque. On later clutches shown in views ("C" and "D"), the screws (1L) should be torqued to 61-78 inch-pounds. On all models, install all six screws (1 or 1L) evenly to prevent warpage and/or damage.

CRANKCASE AND GEARBOX. The rotary valves are located at each end of the crankshaft. Valve on right side can be removed after removing the carburetor, oil pump, clutch drum, engine right side cover, crankshaft (primary drive) gear, clutch gear and rotary valve cover plate. Valve on left side can be removed after removing engine left side cover and the valve cover plate. Care should be taken to prevent valves from absorbing water or becoming too dry. After cleaning valve in solvent, be sure to wipe with oil to prevent complete drying out. The rotary valves (24—Fig. BS4-18) are interchangeable but the drive collars (25 & 26) are not. Valves are correctly timed when the mark (M—Fig. BS4-23) on the valve is aligned with the keyway (K) on drive collar.

To separate the crankcase halves, it is first necessary to remove the engine. Remove both rotary valves, cylinders, pistons and alternator. Remove the four cap screws from top crankcase and the thirteen screws from the bottom. Refer to Figs. BS4-25, BS4-26 and BS4-27.

Carefully check all parts of the transmission. The fingers of shift forks (19, 22 & 23—Fig. BS4-26) should be 0.210-0.214 in. thick. If less than 0.2004 in. thick or if bent, fork should be renewed. Make certain that guide pins (20) and grooves in drum (18) are not worn. If transmission jumps out of gear, check the detent assembly (26, 27 & 28), ratchet pawls (14) and shift forks carefully. If shift pedal does not return smoothly, check the return spring (5), change shaft and arm (2) and ratchet pawls (14).

When assembling apply a good grade of liquid sealer evenly between the halves of the crankcase and tighten the screws in the sequence shown in Fig. BS4-28. The 6MM screws should be tightened to 52-78 inch pounds torque and 8MM screws to 122-174 inch pounds torque.

SPEED TUNING

The following specifications are suggested by the manufacturer for increasing performance of 350 cc models. Any change from original configuration will probably decrease service life of an engine and, if changes are carelessly done, may decrease power and cause extensive damage. The specifications are for a guide only and will void warranty. With the following modifications, final drive sprocket ratio will probably need to be changed.

Road Racing

Horsepower and torque peak will occur at approximately 8500 rpm.

SPARK PLUG AND IGNITION. The coldest plug that can be used without excessive fouling should be installed. NGK type B-10HN or Champion L-54R plugs are suggested. The correct plugs for racing will probably be too cold for starting and warming up.

Breaker point gap should be set at 0.25-0.30 MM (0.010-0.012 inch) for racing instead of standard gap. The ignition timing should be the same as standard (25 degrees BTDC). Piston position at 25 degrees is 3.6 MM (0.142 inch) Before TDC.

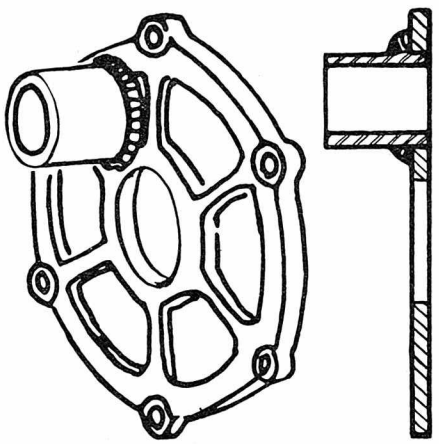


Fig. BST 4-1—View of rotary valve cover showing method of installing tube for larger carburetor. Outside diameter of tube must fit carburetor and inside diameter of tube should match carburetor bore.

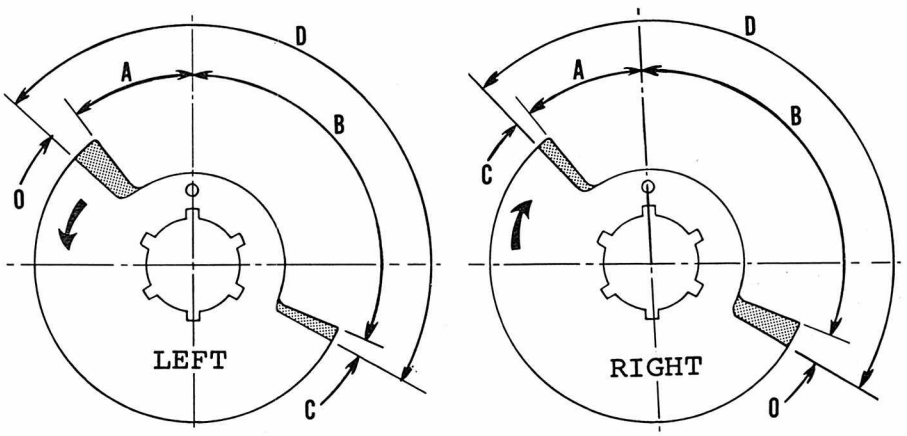


Fig. BST 4-3—The rotary valves are originally the same, but will not be interchangeable after they are modified. Angle (A) is 36.5 degrees; angle (B) is 108.5 degrees; angle (C) is 3.5 degrees; angle (D) is 155 degrees; angle (O) is 6.5 degrees: Opening modification is at (O); closing modification is at (C).

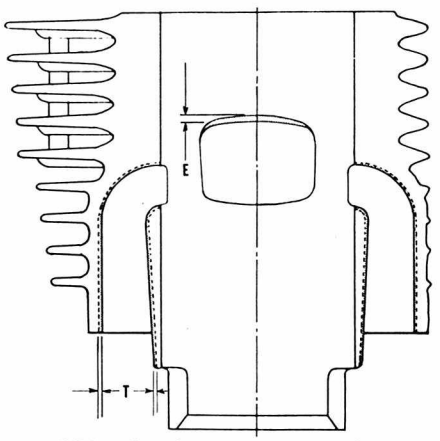


Fig. BST 4-2—The exhaust port should be raised (E) 2 MM, but should remain same shape. Enlarge transfer passages (T), but DO NOT change shape or size of transfer or boost ports.

CARBURETORS. Remote float bowl carburetors with 30 MM bore should be used. Refer to Fig. BST 4-1 for suggested method of adapting the larger carburetor. The original carburetor adapter tube must be removed and a larger tube welded in place. The tube should extend through the cover and inside surface must be smooth. The hole through right side cover must be enlarged for the larger carburetor adapter tube. Refer to the Lubrication paragraph if oil injection system is removed. Make certain that carburetor covers (if used) do not restrict air flow.

LUBRICATION. When oil injection system is used for racing, some additional oil should be mixed with fuel in tank. If the oil injection system is removed, oil to fuel ratio should be 1:15 or 1:20.

PISTONS, CYLINDERS AND HEADS. Pistons should not be modified. Cylinder heads should be milled 1.5-2.0 MM (0.06-0.08 inch) to increase compression. When assembling, make certain that pistons do not contact cylinder heads.

The exhaust port should be raised 2 MM (0.079 inch), but should retain the same shape. The transfer and boost ports should not be changed; however, transfer passages should be enlarged as shown in Fig. BST 4-2.

ROTARY VALVES. The standard rotary valves are the same for both sides; however, the two valves are modified differently. Be sure to identify the valves after modification so they will be installed on the correct side of engine. Refer to Fig. BST 4-3. Both valves should be cut-away 6.5 degrees (O) on opening; 3.5 degrees (C) for closing. Carefully modify the valves, making certain that corners are rounded to prevent breakage at high rpm.

EXPANSION CHAMBERS. Refer to Fig. BST 4-4 and the following specifications for constructing expansion chambers suggested by the manufacturer.

LENGTHS—
A. 115 MM
B. 230 MM
C. 260 MM
D. 70 MM
E. 240 MM
F. 250 MM

DIAMETERS—
G. 33 MM
H. 58 MM
I. 110 MM
J. 28 MM

Scrambling

Horsepower and torque peak will occur at approximately 6000-7000 rpm.

5. **SPARK PLUG AND IGNITION.** NGK type B-8HN or Champion L-57R plugs are suggested. Breaker point gap should be set at 0.25-0.30 MM (0.010-0.012 inch) instead of standard gap. The ignition timing should be same as standard (25 degrees BTDC). Piston position at 25 degrees is 3.6 MM (0.142 inch) Before TDC.

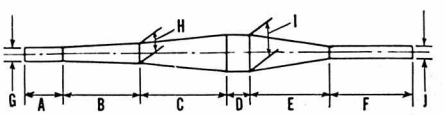


Fig. BST 4-4—Expansion chambers can be constructed to the specifications listed in text. Specifications are different depending on type of racing.

CARBURETORS. The standard carburetors will be satisfactory. The main jet size should be increased to approximately 150.

LUBRICATION. When oil injection system is used for racing, some additional oil should be mixed with fuel in tank. If the oil injection system is removed, oil to fuel ratio should 1:15-1:20.

PISTONS, CYLINDERS, HEADS AND ROTARY VALVES. Pistons and cylinders should not be modified. Cylinder heads should be milled 1.5-2.0 MM (0.06-0.08 inch) to increase compression. When assembling, make certain that pistons do not contact cylinder heads. Rotary valves should not be changed from standard.

EXPANSION CHAMBERS. Refer to Fig. BST 4-4 and the following specifications for constructing expansion chambers suggested by the manufacturer.

LENGTHS—
A. 190 MM
B. 260 MM
C. 280 MM
D. 90 MM
E. 240 MM
F. 250 MM

DIAMETERS—
G. 40 MM
H. 58 MM
I. 105 MM
J. 28 MM

BRONCCO

ENGINE SPECIALTIES INC.
P. O. Box 260
Cornwells Heights, Pa. 19020

APACHE 100

Model	TX-9
Displacement—cc	98.2
Bore—MM	50
Stroke—MM	50
Number of cylinders	1
Oil-Fuel ratio	1:20
Plug gap—inch	0.022-0.024
Point gap—inch	0.014-0.018
Ignition timing	Fixed
Piston position BTDC—inch	0.092
Electrical system voltage	6
Tire size—Front	2.50x19
Rear	3.00x17
Tire pressure—Front	25 P.S.I.
Rear	30 P.S.I.
Rear chain free play—inch	½
Number of speeds	4
Weight—Lbs. (approx.)	165

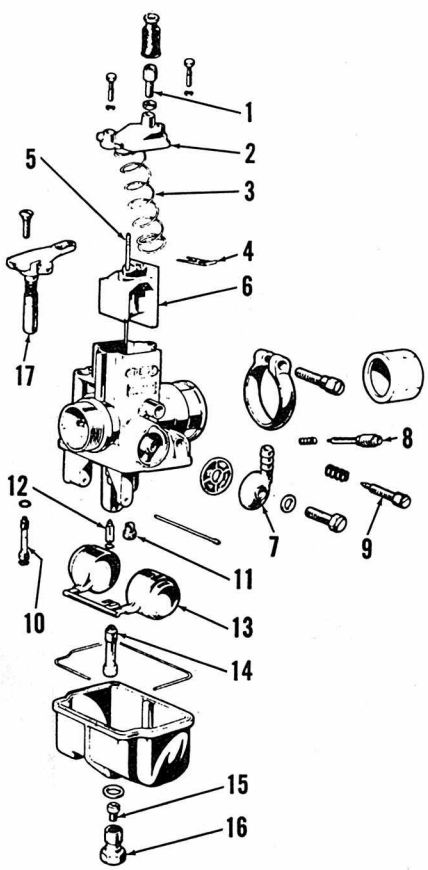


Fig. BR 1—Exploded view of Del'Orto 22 MM carburetor used on all models.

1. Cable adjuster
2. Mixing chamber top
3. Throttle return spring
4. Jet needle clip
5. Jet needle
6. Throttle slide
7. Fuel inlet fitting
8. Idle air adjustment
9. Idle speed adjustment
10. Starter jet
11. Slow jet
12. Float valve
13. Float
14. Needle jet
15. Main jet
16. Main jet holder
17. Starter plunger

MAINTENANCE

SPARK PLUG. An NGK type B-7E with an electrode gap of 0.023 inch is recommended for normal use. For more severe use, a type B-8E or B-9E is recommended.

CARBURETOR. A Del'Orto 22 MM Concentric carburetor is used. (See Fig. BR 1) Normal adjustment of idle air screw (8) is 1¾-2 turns out from a lightly seated position. Refer to Fig. BR 1 and the following chart for standard jet sizes:

Main jet (15)	100
Slow jet (11)	40
Starter jet (10)	70
Jet needle (5)	260 U

Clip (4) should be set in middle notch of needle (5) for initial setting.

IGNITION AND ELECTRICAL. A six volt alternator mounted at left end of crankshaft is used to produce electrical power for lighting and ignition. No battery is used. A cut out switch is mounted on tail light assembly in the event that a filament is burnt out in tail light it may be by-passed to prevent engine stoppage when brake is applied.

Set point gap to 0.016 inch before timing engine. Three timing marks are located on the engine, one on left hand case and two on flywheel. When turning flywheel in normal direction of rotation, the first mark on flywheel will align with timing mark on case as piston reaches 28 degrees BTDC. Ignition points should just open at this time. Second mark will align as piston reaches TDC.

LUBRICATION. Transmission is lubricated by 24 oz. of SAE #30 motor oil. Oil should be maintained at level of plug (P—Fig. BR 3) and should be renewed every 1250 miles.

Engine lubrication is accomplished by mixing two stroke motorcycle oil with gasoline at a ratio of 20 parts gasoline to 1 part oil. To break in new or overhauled engine, use a 16:1 mixture.

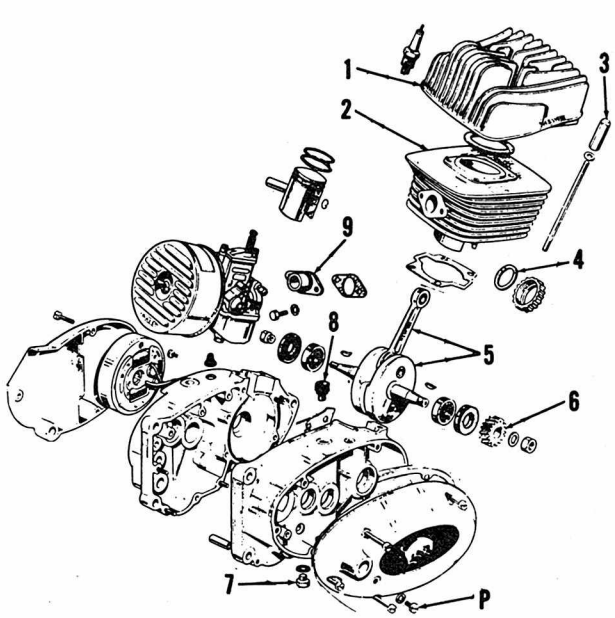


Fig. BR 2—Engine assembly used in Apache 100. Carburetor mounting flange (9) may have to be removed with carburetor intact to aid in removal of cylinder.

1. Cylinder head
2. Cylinder
3. Cylinder hold down nut
4. Exhaust gasket
5. Connecting rod and crankshaft assembly
6. Primary drive gear
7. Oil drain plug
8. Oil filler plug
9. Carburetor mounting flange

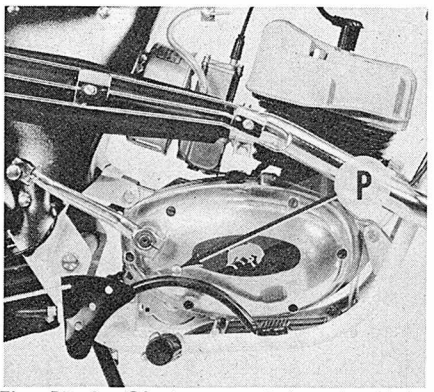


Fig. BR 3—Oil in transmission should be maintained at level of plug (P).

CLUTCH CONTROLS. Adjust clutch cable at either end to obtain ¼ inch free play in lever on handle grip. To adjust clutch, remove kickstart lever and right side engine cover. Loosen lock nut on adjusting screw (8—Fig. BR 4) and back screw out until loose. Turn screw in until a slight resistance is felt and then back it out ½ turn and tighten lock nut (7).

SUSPENSION. Each front suspension unit contains 150cc of SAE 30 motor oil. Oil should be drained and renewed every 1250 miles. Oil may be drained from forks by removing small plug at lower end of outer fork tube.

Rear suspension units are not repairable and should be renewed if leaking or damaged.

REPAIRS

CYLINDER, HEAD AND PISTON. Cylinder and piston may be removed without removing engine from frame. Refer to the following repair specifications:

Piston skirt to cylinder clearance—
Normal use .....0.003-0.0035 inch
Competition use ...0.005-0.006 inch
Piston ring
end gap .....0.008-0.013 inch
Maximum cylinder taper or
out of round .....0.002 inch

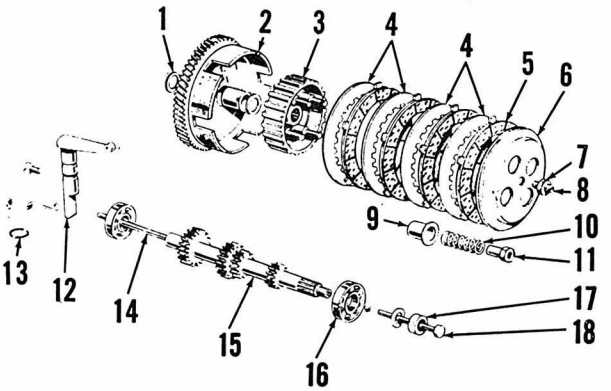
Install piston with ring lock pins toward rear (intake side) of cylinder. If a new piston is fitted, it will be necessary to drill two $\frac{3}{32}$ inch holes, one on the bottom of each pin boss. After drilling lubrication holes in pin bosses, ream pin hole for a snug but not binding fit of piston pin.

Any play in small end rod bushing will warrant replacement of bushing. File a notch in old bushing and pull out. Press or pull a new bushing in place (do not pound bushing in) and drill two holes in bushing using the existing holes in rod as guides. Ream bushing after drilling holes so that piston pin is a snug fit. Five oversizes of pistons are available.

Torque head retaining nuts to 12 Ft.-Lbs. using a cross pattern to prevent warpage.

Fig. BR 4 — Component parts of TX 9 clutch assembly and actuating parts.

1. Thrust washer
2. Clutch drum
3. Clutch hub
4. Steel plates
5. Friction discs
6. Pressure plate
7. Lock nut
8. Adjusting screw
9. Spring cup
10. Clutch spring
11. Spring holder
12. Release lever
13. "O" ring
14. Push rod
15. Primary shaft
16. Ball bearing
17. Clutch hub securing nut
18. Operating rod



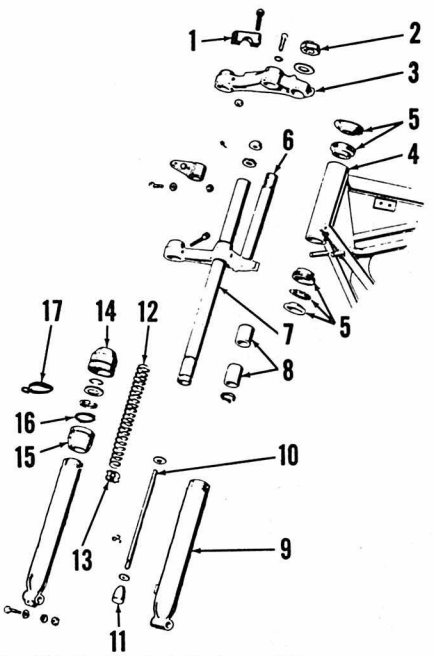


Fig. BR 5—Exploded view of front suspension units.

1. Handle bar clamp
2. Upper seal
3. Upper fork plate
4. Frame
5. Steering bearing set
6. Steering stem
7. Inner fork tube
8. Bushings
9. Outer fork tube
10. Fork stop rod
11. Stop rod anchor
12. Fork spring
13. Spring retainer
14. Dust cover
15. Locking cap
16. Fiber washer
17. Lock ring

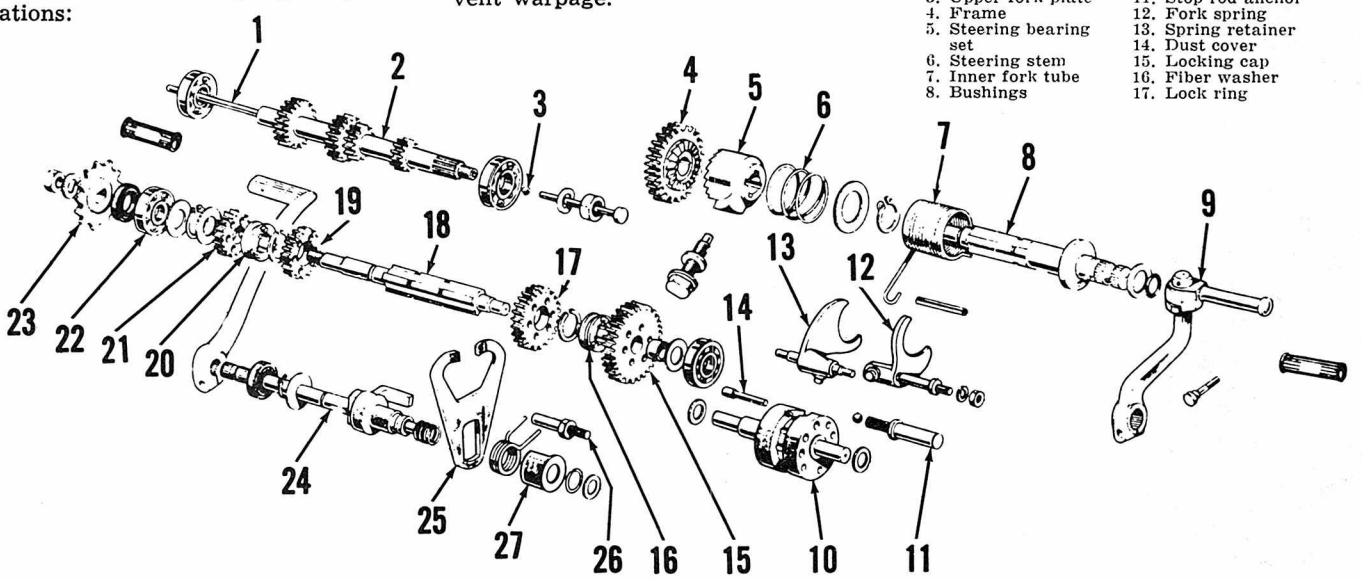


Fig. BR 6—Exploded view of transmission and kickstarter assembly.

1. Clutch actuating rod
2. Primary shaft
3. Steel ball
4. Kickstarter gear
5. Kickstarter ratchet
6. Push spring
7. Return spring
8. Kickstarter shaft
9. Kick lever
10. Shift drum
11. Shift detent spring holder
12. Shift fork
13. Shift fork
14. Shift drum pin
15. First gear
16. First & second gear slider
17. Second gear
18. Secondary shaft
19. Third gear
20. Third & fourth gear slider
21. Fourth gear
22. Ball bearing
23. Drive sprocket
24. Shift shaft
25. Operating fork
26. Return spring pin
27. Shift spring cup

CRANKSHAFT AND CRANKCASE. Crankcase halves must be separated to remove crankshaft. Crankshaft should only be disassembled if proper tools are available to reassemble correctly. Maximum crankshaft runout is 0.0005 inch.

Keyslot for primary gear woodruff key is different on some models. If a replacement key does not readily fit it may be modified.

CLUTCH. Clutch is a wet multi-disc unit operated by a push rod running through the transmission shaft. Friction discs should be renewed if worn or chipped. Renew steel plates if warped or glazed.

TRANSMISSION. Inspect gears and gear dogs for wear or chipping. Reinstall thrust washers in original position on transmission shafts to retain proper fit in cases. Renew both parts of kickstarter ratchet if any one of them show signs of excessive wear. Pins in shift drum should fit securly.

B.S.A.

BSA MOTORCYCLE CORP

EAST
80 Pompton Ave.
Verona, N.J. 07044

WEST
2745 E. Huntington Drive
Durante, CA. 91010

D1 AND D7 MODELS

MODELS	D1	D7
Displacement-cc	123	174
Bore-MM	52	61.5
Stroke-MM	58	58
Number of Cylinders	1	1
Oil-fuel ratio	1 to 20	1 to 20
Plug gap-inch	0.018-0.020	0.018-0.020
Point gap-inch	0.015	0.015
Ignition timing	Fixed	Fixed
Degrees BTDC	See Text	17
Electrical system voltage	3 and 6	6
Battery terminal grounded	Positive	Positive
Tire size	2.75 X 19	3.00 X 18
Tire pressure psi-front*	16	16
rear**	22	21
Rear chain free play-inch	¾	¾
Number of speeds	3	3
Weight-lbs. (approx.)	187	224

* Add 1 psi for every 28 lbs. increase in riders weight above 140 lbs.
**Add 1 psi. for every 14 lbs. increase in riders weight above 140 lbs.

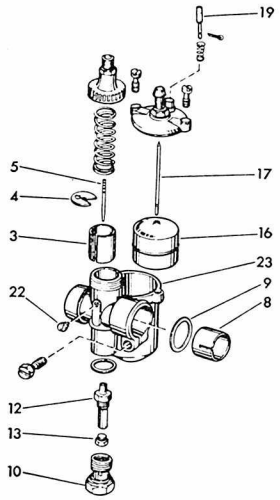


Fig. B1-1 — Exploded view of carburetor typical of type used on D1 model.

3. Throttle slide
4. Clip
5. Needle valve
8. Bushing
9. Gasket
10. Nozzle holder
12. Nozzle
13. Main jet
16. Float
17. Float valve
19. Primer
22. Throttle slide guide screw

MAINTENANCE

SPARK PLUG. Champion model L7 plug should be used with 0.018-0.020 inch electrode gap.

CARBURETOR. Amal carburetors are used on both models. Refer to Fig. B1-1 or B1-2 and the following table for repair information. Clip (4) should be installed in the second groove from top of needle (5) on both models.

MODEL	D1	D7
Carburetor Type	361/8	375/31 or /60
Main Jet (13)	75	140
Pilot Jet (6)	—	25
Needle Jet	.106	.1055
	(12—Fig. B1-1)	(11—Fig. B1-2)

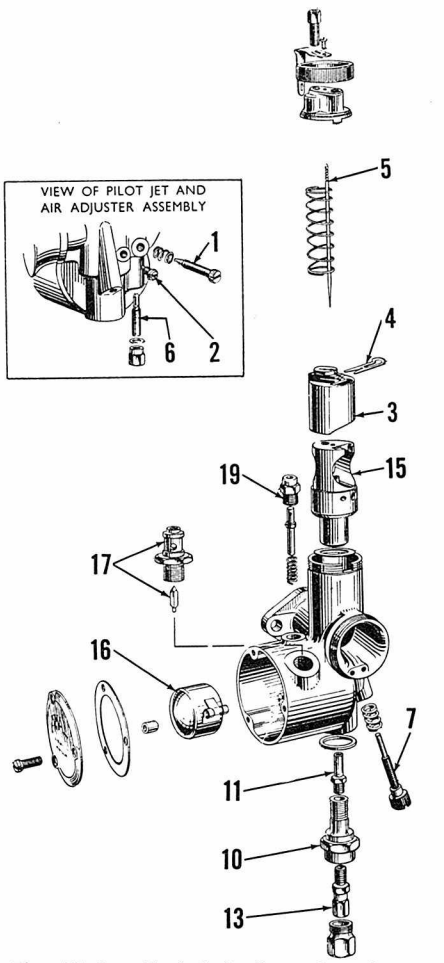


Fig. B1-2 — Exploded view of carburetor typical of type used on D7 model.

1. Pilot air (idle mixture) screw
2. Jet block locking screw
3. Throttle slide
4. Clip
5. Needle valve
6. Pilot jet
7. Idle speed adjusting screw
10. Nozzle holder
11. Needle jet
13. Main jet
15. Jet block
16. Float
17 Float valve
19. Primer

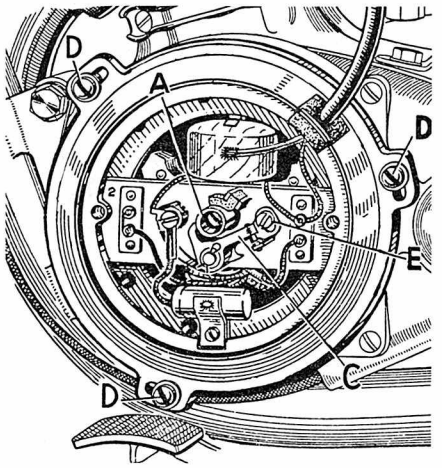


Fig. B1-3—Ignition timing is adjusted by moving the stator plate after loosening three screws (D).

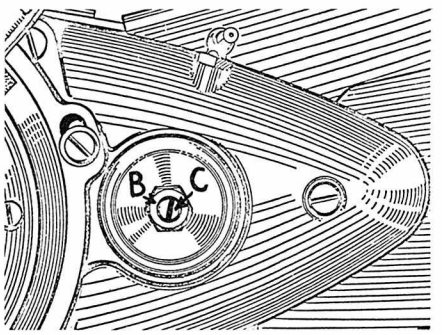
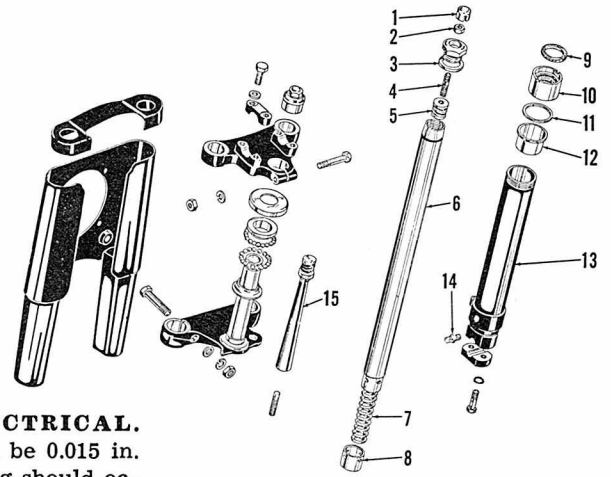


Fig. B1-8—View of clutch adjustment screw (C) and locknut (B).

1. Oil seals
2. Snap rings
3. Bearings
4. Thrust washers
5. Cover plate
6. Pressure plate
7. Spring cup (6 used)
8. Spring (6 used)
9. Back plate
10. Friction plate (3 used)
11. Steel plate (2 used)
12. Clutch hub
13. Clutch drum and sprocket
14. Starter pinion
15. Spring
16. Spring cup
17. Bushing
18. Clutch rod
19. Steel ball
20. Bushing
21. Input shaft
22. Second and high sliding gear
23. Bushings (2 used)
24. Output gear and shaft
25. Seal bushing
26. Output sprocket
27. Clutch operating lever
28. Clutch adjusting screw
29. Low idler gear
30. Low and Second sliding gear
31. Idler shaft
32. Idler gear
33. Bushings (2 used)
34. Gear shift lever
35. Shifter shaft
36. Spring cup
37. Spring
38. Selector fork
39. Pad
40. Bracket
41. Lock plate (2 used)
42. Ratchet plate
43. Spring
44. Cup
45. Pin
46. Detent ball
47. Crankshaft sprocket
48. Kick starter
49. Starter shaft
50. Starter gear
51. Return spring

Fig. B1-9—Exploded view of telescopic front suspension.

5. Spring anchor
6. Shaft
7. Spring
8. Lower bushing
9. Oil seal
10. Collar
11. Washer
12. Upper bushing
13. Tube
14. Drain plug
15. Restrictor rod



IGNITION AND ELECTRICAL. Ignition point gap should be 0.015 in. (0.38 mm). Ignition timing should occur at 26½ degrees BTDC or when piston is 0.1575 in. (4.0 mm) BTDC on 125 cc models. Timing for 175 cc models is 17 degrees BTDC or when piston is 0.062 in. (1.6 mm) BTDC. Timing is adjusted by rotating the stator plate after loosening screws (D—Fig. B1-3).

The electrical current is supplied by a flywheel type alternator and on basic models provides A.C. current for lighting. On 125 cc motorcycles equipped with battery lighting, the alternator charges the battery via a rectifier and lights, horn etc. receive D.C. from the battery. On 175 cc models with a battery, three lighting coils are housed in the stator plate. The two outer coils provide A.C. current for headlight, so engine must be running for the headlight to operate. The small coil in the center charges the battery via a full wave rectifier. The battery operates parking lights, stop light and horn.

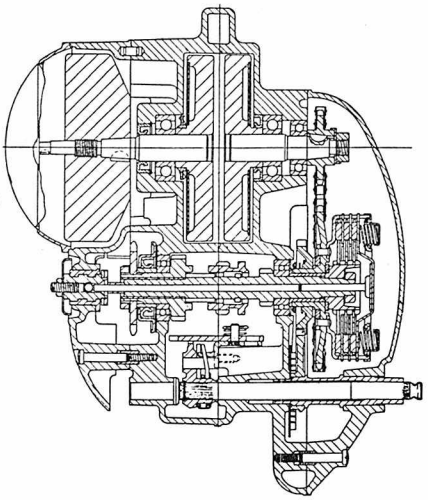


Fig. B1-15—Cross sectional view of engine and transmission assembly.

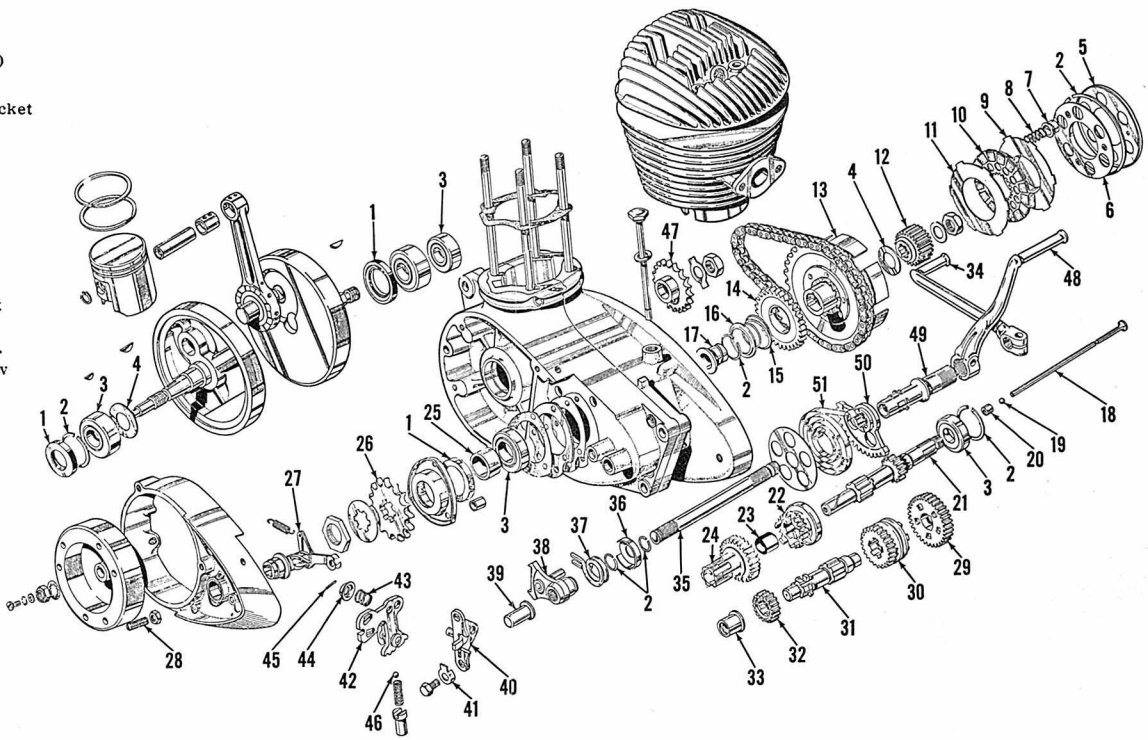


Fig. B1-18—Exploded view of engine and transmission assembly.

LUBRICATION. Engine is lubricated by mixing SAE 40 two stroke engine oil with the fuel. Normal ratio is 1:20. The gear box is lubricated with ¾ pint (425 cc) SAE 40 motor oil. Gear box oil should be maintained at mark on filler plug dipstick. Oil should be drained and serviced every 2000 miles.

CLUTCH. The clutch, located on right side of engine, is of the multiple disc, wet type. Adjustment is by screw (C—Fig. B1-8) located on left side of engine. Loosen lock nut (B) and back screw (C) out slightly. Tighten the adjusting screw until resistance is felt. NOTE: Do not force. Back screw out ½ turn and tighten lock nut. Adjust cable to take up excessive play in controls.

SUSPENSION. The telescopic front suspension is shown in Fig. B1-9. Each telescopic unit contains ⅛ pint (70 cc) SAE 20 motor oil and can be drained and serviced after removing cap (1), nuts (2 and 3) and stud (4). Rear suspension units are sealed and are available only as complete units.

REPAIRS

PISTON, RINGS AND PINS. The piston can be removed after first removing the exhaust pipe, carburetor, cylinder head and cylinder.

Ring end gap should be 0.009-0.013 inch. Piston clearance in bore at bottom of piston skirt should be 0.0027-0.0045 inch for D1, 0.003-0.005 inch for D7. D1 piston pin bushing in rod should be sized after installation to 0.4692-0.4697 inch. Standard cylinder bore diameter is 52 MM (2.0472 in.) for D1, 61.5 MM (2.42125 in.) for D7. Pistons and rings are available in standard size and two oversizes. Piston should be reinstalled with ring gaps toward rear on D1, toward front on D7 models. Piston pin is full floating type and is held in place with snap rings.

CONNECTING ROD AND CRANKSHAFT. The crankshaft is supported in three ball type main bearings. The connecting rod, bearings and crankpin are available as a unit and can be installed after pressing crankshaft apart. It is extremely important that crankshaft be perfectly true and therefore it is recommended that ONLY shops equipped with the necessary special tools replace the crankpin, rod and bearing assembly. Main bearings can be replaced after removing crankshaft.

CRANKCASE AND GEAR BOX. To disassemble the crankcase and gear box, the engine must first be removed. Remove the cylinder head, cylinder, piston, flywheel and clutch. Remove the screws that attach the crankcase halves together and carefully separate the halves. There is no gasket used between the halves.

NOTE: Be careful not to damage sealing surfaces of crankcase. The transmission gears are shown in Figs. B1-15 and B1-18.

DUCATI

BERLINER MOTOR CORP.
Railroad St. and Plant Rd.
Hasbrouck Heights, N.J. 07604

48 AND 100CC MODELS

MODEL	48 Cacciatore	48SL	100 Cadet	100 Mountaineer
Displacement-cc	47.6	47.6	94	94
Bore-MM	38	38	51	51
Stroke-MM	42	42	46	46
Number of cylinders	1	1	1	1
Oil-fuel ratio	1 to 20	1 to 20	1 to 16	1 to 16
Plug gap-inch	0.020	0.020	0.020	0.020
Point gap-inch	0.014	0.014	0.014	0.014
Ignition timing	fixed	fixed	fixed	fixed
degrees BTDC	15-18	15-18	16-18	16-18
Electrical system voltage	6	6	6	6
Tire size-front	2.50 X 18	2.25 X 18	2.25 X 18	2.50 X 16
rear	3.25-3.50 X 16	2.50 X 17	2.50 X 18	3.25-3.50 X 16
Tire pressure psi-front	25	25	25	25
rear	32	32	32	32
Rear chain free play-inch	½-¾	½-¾	½-¾	½-¾
Number of speeds	3	3	3 or 4	3 or 4
Weight-lbs. (Approx.)	139	130	145	150

MAINTENANCE

SPARK PLUG. Recommended spark plug is Marelli CW26ON, Champion L5 or Autolite AE2. Electrode gap should be 0.5 MM (0.020 in.).

CARBURETOR. Del'Orto UA15S is used on 48cc models; UA18S on 94cc models. Fig. DC1-1 shows exploded view of similar carburetor. Idle mixture is adjusted at screw (1) and idle speed at screw (7). Clip (4) should normally be installed in second groove from top of needle (5) for 94cc models, third groove from top on 48cc models. Intermediate speed mixture can be enriched by lowering clip. Refer to the following specifications.

48cc Models

Carburetor model	UA15S
Main jet (13)	68
Idle jet (6)	45
Atomizer (11)	260

94cc Models

Carburetor model	UA18S
Main jet (13)	82
Idle jet (6)	35
Atomizer (11)	260

IGNITION AND ELECTRICAL. A flywheel type magneto is used and includes separate coils for ignition and lighting systems. Low tension coils, ignition points and condenser are located on right side of engine under the flywheel. Ignition point gap should be set to 0.3-0.4 MM (0.012-0.016 in.). Ignition timing should occur (points just open) at 16-18 degrees BTDC. If timing is incorrect, the coil stator plate can be moved in the elongated holes after loosening the mounting screws.

LUBRICATION. The engine is lubricated by mixing SAE 30 two stroke motor oil with the gasoline. For new engines, ratio should be 1:16 for 48 cc, 1:14 for 94cc. After break-in, normal ratio is 1:20 for 48 cc, 1:16 for 94 cc. The clutch and gear box is lubricated by SAE 20W-40 multigrade motor oil contained in the gear box. Capacity is 0.55 pint for 48 cc, 0.66 pint for 94 cc. Gear box oil should be maintained about 5 MM (3/16 in.) below lower edge of cover opening on engine left side.

CLUTCH. The clutch located on left side of engine, is of the multiple disc, wet type. The clutch hand lever should have approximately 1/16 in. free play at (B—Fig. DC1-2). Adjustment is accomplished at the engine end of cable.

SUSPENSION. Each front suspension unit contains 20 cc (1.22 cu. in.) of SAE 30 motor oil. Rear suspension units are sealed and should be renewed if bent, leaking or damaged.

REPAIRS

PISTON, RINGS AND PIN. The piston can be removed after first removing cylinder cowling, exhaust pipe,

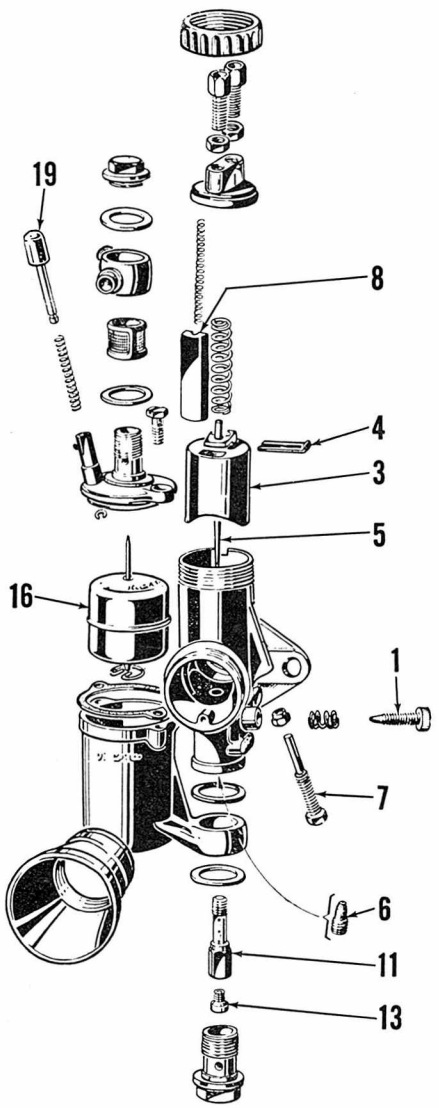


Fig. DC1-1 — Exploded view of Del'Orto carburetor typical of type used on 48 and 94 cc models.

1. Idle mixture screw
3. Throttle slide
4. Clip
5. Valve needle
6. Idle jet
7. Idle speed stop screw
11. Atomizer
13. Main jet
16. Float
19. Tickler

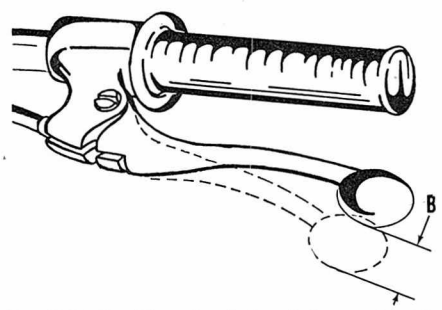


Fig. DC1-2—The clutch hand lever should have approximately 1/16 in. free play at B.

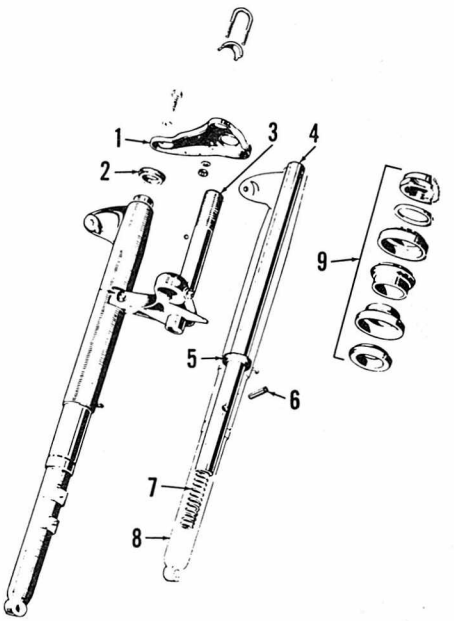


Fig. DC1-3—View of typical front suspension system used on small displacement Ducati motorcycles.

1. Top fork mount
2. Bearing race
3. Steering stem
4. Fork inner tube
5. Oil seal
6. Lock pin
7. Fork spring
8. Outer fork tube
9. Bearing package

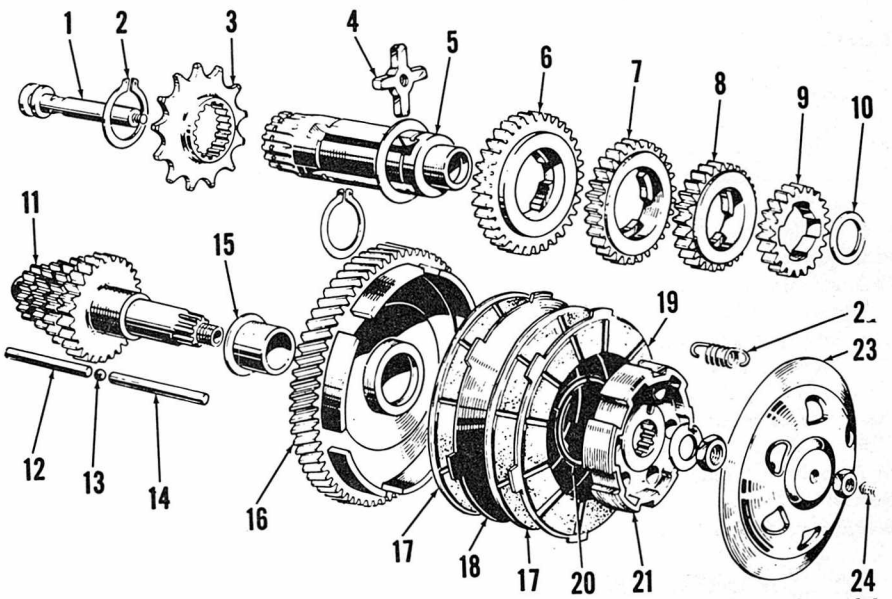


Fig. DC1-4—Exploded view of clutch and transmission assembly common to all models.

1. Shifter slide
2. Snap ring
3. Drive sprocket
4. Engagement cross
5. Output shaft
6. First gear
7. Second gear
8. Third gear
9. Fourth gear
10. Washer
11. Input cluster
12. Push rod
13. Ball
14. Push rod
15. Bushing
16. Primary clutch mounting
17. Friction discs
18. Steel disc
19. Friction disc
20. Steel ring
21. Clutch hub
22. Clutch spring
23. Pressure plate
24. Adjusting screw

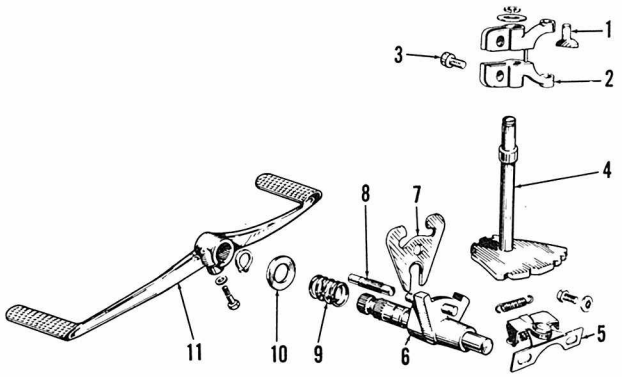


Fig. DC1-5 — Exploded view of Ducati shifter assembly used on small displacement models.

1. Shoe
2. Shift fork
3. Screw
4. Shift rod
5. Lever assembly
6. Shift shaft
7. Pawl lever
8. Drift pin
9. Spring
10. Washer
11. Shift lever

carburetor, cylinder head and cylinder.

Ring end gap should be 0.1-0.8 MM (0.0039-0.0315 in.). Piston should have 0.05-0.10 MM (0.00197-0.00394 in.) clearance in cylinder bore. Standard cylinder bore diameter is 38 MM (1.4961 in.) for 48 cc, 51 MM (2.0079 in.) for 94 models. Piston and rings are available in standard size and two oversizes. Piston should be installed with arrow on top pointed toward front (exhaust port). Piston pin is full floating type and is held in place with snap rings. Fins on cylinder head should run from front to rear.

CONNECTING ROD AND CRANKSHAFT. The crankshaft is supported in ball type main bearings. Bearings and/or crankshaft can be removed after separating the crankshaft halves. The connecting rod and crankshaft are available only as a complete assembly and should NOT be disassembled.

CRANKCASE AND GEAR BOX. To disassemble the crankcase and gear box, the engine must first be removed. Remove the cowling, cylinder head, cylinder, piston, flywheel, magneto stator plate, clutch cover and clutch. Remove screws that attach crankcase halves together and carefully separate the halves. Dowel pins are installed between the halves. Be careful not to damage sealing surfaces of crankcase.

GARELLI (FORMERLY REX)

MECCANICA GARELLI S.p.A.
Milan, Italy

50 AND 100CC MODELS

MODEL	KL50, KL55, KL55M, KL75 & KL75M	KL100, KL100A & KL100M
Displacement-cc	49	94.25
Bore-MM	40	50
Stroke-MM	39	48
Number of cylinders	1	1
Oil-fuel ratio	1 to 20	1 to 20
Plug gap-inch	0.020-0.024	0.020-0.024
Point gap-inch	0.014-0.018	0.014-0.018
Ignition timing	Fixed	Fixed
Degrees BTDC	23	23
Electrical system voltage	6	6
Tire size	2.25x19	2.50x19
Tire pressure-front	20	20
Rear (solo)	26	26
Recr chain free play-inch	⅛	⅛
Number of speeds	3 or 4	4
Weight-lbs. (approx.)	150	160

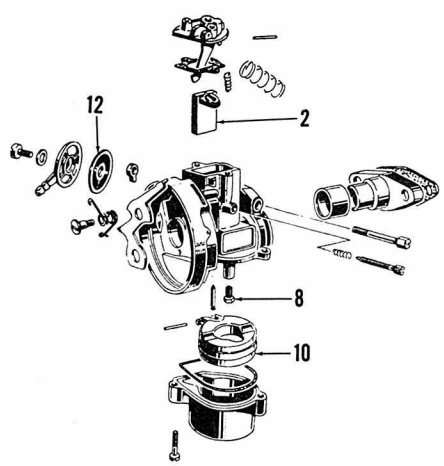


Fig. GA1-1—Exploded view of Del'Orto SHA type carburetor used on KL50 models.

2. Throttle slide
8. Main jet
10. Float
12. Filter

MAINTENANCE

SPARK PLUG. On 50cc models, the recommended spark plug for normal use is Champion N-3. On 100cc models, recommended spark plug for 14MM heads is Champion L-86 and Champion D-6 for 18MM heads. Spark plug electrode gap should be 0.020-0.024 inch for all models.

CARBURETOR. Del'Orto carburetors are used on all models. On model KL50, SHA14/12 carburetor (Fig. GA1-1) is used. On all other models, ME18BS type carburetor is used. Main jet (8) standard size for KL50 is 48. Refer to Fig. GA1-2 and the following specification data for all models except KL50.

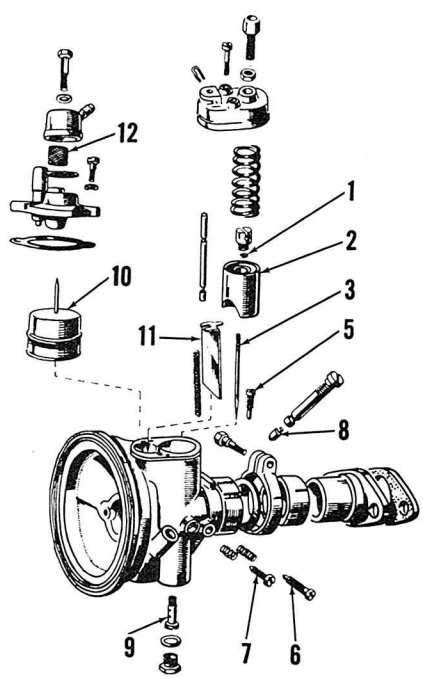


Fig. GA1-2—Exploded view of Del'Orto ME type carburetor typical of all models except KL50.

1. Clip
2. Throttle slide
3. Valve needle
5. Pilot jet
6. Idle mixture needle
7. Idle stop screw
8. Main jet
9. Needle jet
10. Float
11. Choke slide
12. Filter

KL55, KL55M, KL75 & KL75M

Main jet (8) 74
Pilot jet (5) 35
Needle jet (9) 258A
Valve needle (3) G3
Clip (1) in second groove from top of needle (3). Idle mixture needle (6) ¾-turn open.

KL100

Main jet (8) 77
Pilot jet (5) 35
Needle jet (9) 258A
Valve needle (3) G3
Clip (1) in third groove from top of needle (3). Idle mixture needle (6) ¾-turn open.

KL100A & KL100M

Main jet (8) 75
Pilot jet (5) 35
Needle jet (9) 258A
Valve needle (3) G3
Clip (1) is second groove from top of needle (3). Idle mixture needle (6) ¾-turn open.

IGNITION AND ELECTRICAL. Ignition breaker point gap should be 0.014-0.018 inch and can be adjusted through openings in flywheel. Ignition timing should occur at 23° BTDC. The breaker points should just open when mark on flywheel is aligned with mark in crankcase as shown at M—Fig. GA1-4. If ignition timing is incorrect, it is necessary to loosen the three stator plate retaining screws then move the stator plate until the breaker points just open when marks (M) are aligned.

LUBRICATION. The engine is lubricated by mixing SAE 30 two stroke oil with the fuel. Normal ratio is 1:20. The gear box is lubricated by approximately 1 pint of SAE 30 oil contained in the clutch and transmission compartments. Oil should be maintained at level of dipstick on filler plug at front of left side cover. Oil should be drained and refilled every 2,500 miles.

CLUTCH CONTROLS. The wet type clutch is located on the left end of the transmission input shaft. The hand lever should have approximately ⅛-inch free play. Adjustment is normally accomplished at hand lever end of cable. Further adjustment is accomplished by turning screw (16—Fig. GA1-6) after loosening lock nut (17).

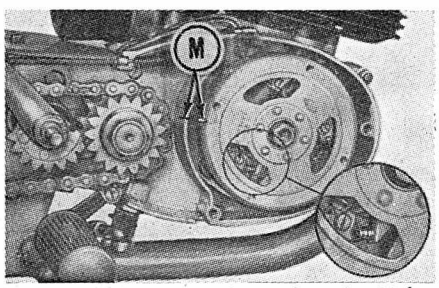


Fig. GA1-4—The breaker points should just open as timing marks (M) are aligned.

REPAIRS

PISTON, RINGS AND CYLINDER. The piston can be removed after removing the cylinder head and cylinder. Use care to prevent dropping piston pin bearing needles and washers into crankcase when piston is lifted off. Oversize pistons and piston rings are available.

When assembling, grease the piston pin needle rollers and position in the connecting rod. On 50cc models, 21 bearing rollers are used, 19 are used on 100cc models. Position the piston pin side washers with rubber side or cupped side out toward piston bosses and flat, metal side toward rollers. Assemble piston on connecting rod with "S" mark stamped on top of piston toward front (exhaust). Be careful that piston pin does not catch on rollers when assembling.

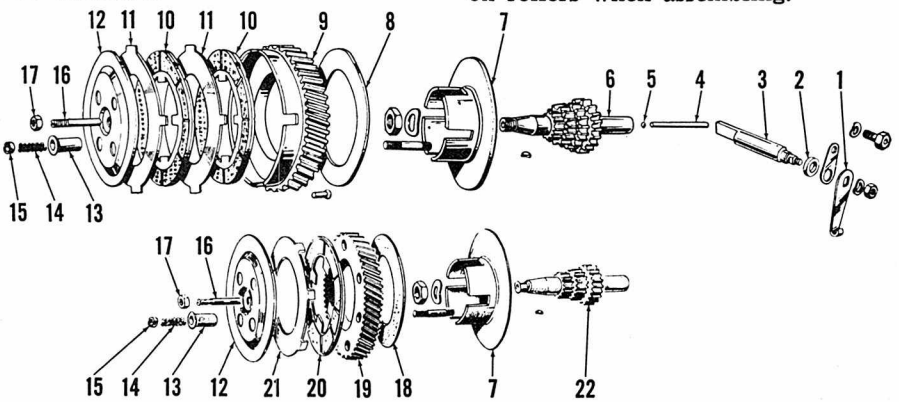
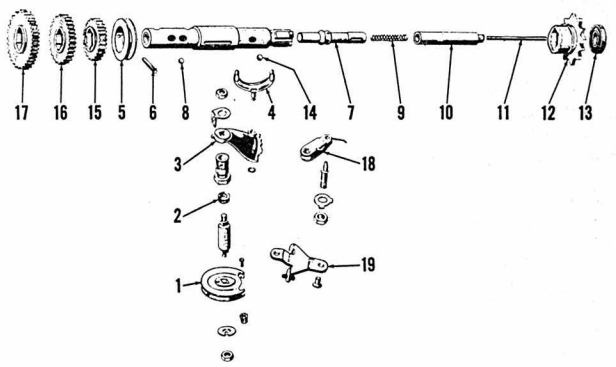


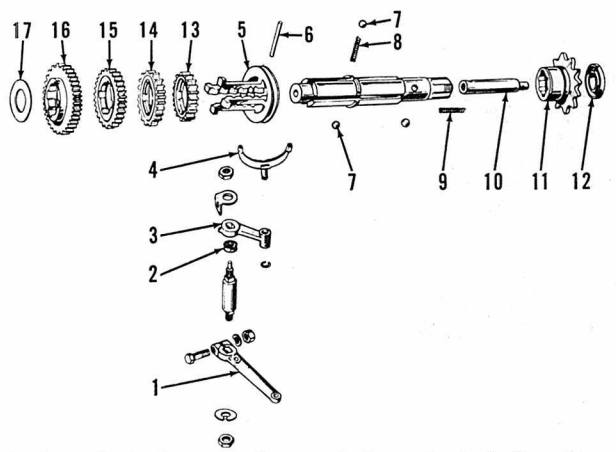
Fig. GA1-6—Exploded view of clutch assembly. The clutch assembly at top is used with four speed transmissions. The clutch shown at bottom is used with three speed transmissions.

1. Lever
2. Seal
3. Actuating cam
4. Rod
5. Ball (7/32-inch)
6. Cluster gear (4 speed)
7. Clutch hub
8. Friction disc (4 speed)
9. Clutch drum and gear
10. Friction discs (2 used)
11. Steel plates (2 used)
12. Pressure plate
13. Spring cup
14. Springs
15. Spring nut
16. Adjusting screw
17. Lock nut
18. Friction disc (3 speed)
19. Primary gear (3 speed)
20. Friction disc (3 speed)
21. Steel plate (3 speed)
22. Cluster gear (3 speed)



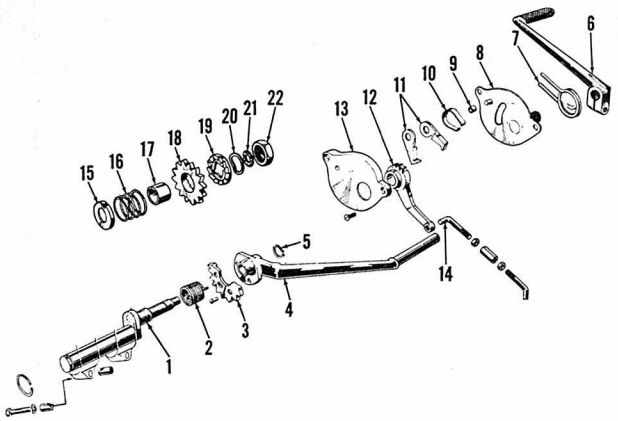
1. Shift cable quadrant
2. Seal
3. Shift lever
4. Shift fork
5. Shift collar
6. Pin
7. Sliding pin
8. Gear engaging balls (6 used)
9. Spring
10. Engaging rod
11. Pin
12. Output sprocket
13. Seal
14. Output sprocket balls (4 used)
15. Third gear
16. Second gear
17. First gear
18. Detent
19. Cable bracket

Fig. GA1-8—Exploded view of three speed transmission output shaft and gears.



1. External gear change lever
2. Seal
3. Lever
4. Shift fork
5. Shift collar and engaging lugs
6. Pin
7. Detent balls
8. Spring
9. Spring
10. Engagement rod
11. Sprocket
12. Seal
13. Fourth gear
14. Third gear
15. Second gear
16. First gear
17. Washer

Fig. GA1-9—Exploded view of the four speed transmission output shaft and gears.



1. Shaft
2. Kick starter return spring
3. Starter quadrant
4. Kick starter pedal
5. Snap ring
6. Gear change pedal
7. Return spring
8. Shaft and bracket
9. Roller
10. Ratchet spring
11. Ratchets
12. Ratchet lever
13. Bracket cover
14. Link rod
15. Spring seat
16. Spring
17. Sleeve
18. Kick starter gear
19. Ratchet
20. Spring washer
21. Gasket
22. Nut

Fig. GA1-10—Exploded view of the kick starter and foot operated gear shift linkage.

CONNECTING ROD AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. The crankshaft, connecting rod, crankpin and roller bearings are available only as a unit. The crankshaft and connecting rod should not be disassembled.

CRANKCASE AND GEAR BOX. To separate the crankcase halves, first remove the engine assembly from the frame. Remove cylinder head, cylinder, piston and complete magneto assembly. Remove the output sprocket, clutch assembly and crankshaft primary drive gear. Remove the 9 screws attaching halves together and bump ends of crankshaft and transmission input shaft to separate the halves. Refer to Figs. GA1-8, GA1-9 and GA1-10.

HARLEY-DAVIDSON

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wisconsin

125, 165 AND 175CC MODELS (BEFORE 1967)

MODEL	125 & Hummer	Ranger, Pacer (BTU), 165 & Super 10	Pacer (BT) & Scat
Displacement-cc	124.87	165	175
Bore-MM	52.39	60.3	60.3
Stroke-MM	57.94	57.94	61.11
Number of cylinders	1	1	1
Oil-fuel ratio	1 to 25	1 to 25	1 to 25
Plug gap-inch	0.025-0.030 for battery ignition; 0.040-0.045 for magneto-		
Point gap-inch	——0.020 for battery ignition; 0.018 for magneto——		
Ignition timing	Fixed	Fixed	Fixed
Degrees BTDC	——29-31 for battery ignition; 31-33 for magneto——		
Electrical system voltage	6	6	6
Battery terminal grounded	Negative	Negative	NA
Tire size	——3.50 X 16 or 3.50 X 18——		
Tire pressure psi-front*	12	12	12
rear**	14	14	14
Rear chain free play-inch	½	½	½
Number of speeds	3	3	3

*Add 1 psi for every 50 lbs. increase in riders weight above 150 lbs.
**Add 2 psi for every 50 lbs. increase in riders weight above 150 lbs.

MAINTENANCE

SPARK PLUG. Recommended plug for average use is Harley-Davidson No. 4, 14mm plug. Heat range depends upon application. Harley-Davidson plugs are numbered 2, 3, 4, and 5, with lowest number being hottest plug. Electrode gap should be 0.025-0.030 inch for battery ignition; 0.040-0.045 inch for magneto. Spark plug should be torqued to 15 Ft.-Lbs.

CARBURETOR. Models 125, 165, Ranger, Pacer and Scat use a Del 'Orto carburetor similar to that shown in Fig. HD2-1. Four mixture variations are provided by means of the grooves in the metering pin (5) into which retainer (4) fits. Normal setting is with retainer in the second groove from the top. Installation of retainer in a lower groove will richen the midrange mixture.

Hummer and Super-10 models use a Tillotson MT carburetor similar to that shown in Fig. HD2-2. Clockwise rotation of both idle mixture needle (12) and high speed mixture needle (9) leans the mixture. Normal set-

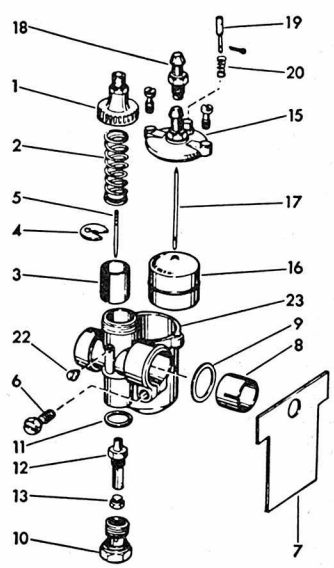


Fig. HD2-1—Exploded view of carburetor typical of type used on models 125, 165, Ranger, Pacer and Scat.

1. Throttle piston cap
2. Throttle piston spring
3. Throttle piston
4. Throttle metering pin retainer
5. Throttle metering pin
6. Mounting screw
7. Carburetor insulator
8. Carburetor to cylinder bushing
9. Carburetor gasket
10. Nozzle holder
11. Nozzle holder gasket
12. Nozzle
13. Metering jet
15. Float bowl cover
16. Carburetor float
17. Float valve
18. Float valve seat
19. Float primer pin
20. Float primer spring
22. Throttle piston guide screw
23. Carburetor body

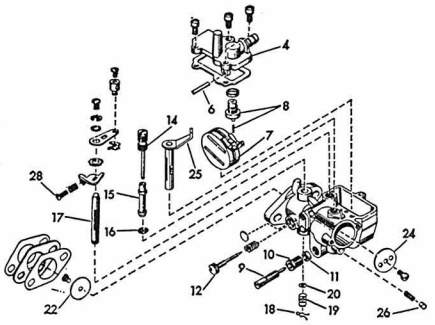


Fig. HD2-2 — Exploded view of Tillotson MT carburetor typical of type used on Hummer and Super-10.

4. Bowl cover
6. Float pivot pin
7. Float
8. Inlet needle, seat and spring
9. Main adjusting needle
10. Packing nut
11. Packing
12. Idle mixture needle
14. Idle tube
15. Nozzle
16. Gasket
17. Throttle shaft
18. Retaining clip
19. Spring
20. Seal
22. Throttle shutter
24. Choke shutter
25. Choke shaft
26. Choke friction pin
28. Low idle stop screw

ting is ¾ turn open for idle needle; 1 turn open for high speed needle.

BATTERY AND IGNITION TIMING. Models 125 and 165 have a 6-volt generator and battery ignition system. The ignition breaker points and condenser (Fig. HD2-3) are located on the engine right side and are accessible after removing the inspection cover. Recommended point gap of 0.020 inch can be obtained by turning the eccentric adjusting screw (3) after first loosening the lock screw(14). To set the timing, first check and reset breaker point gap and position crankshaft at 29-31 degrees BTDC. Loosen lock screws (1 & 7) and shift breaker point assembly so that points are just starting to open. Retighten screws (1 & 7).

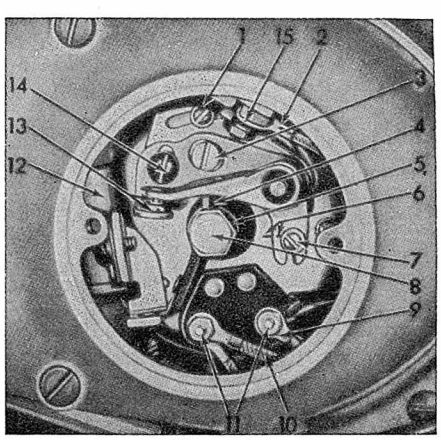


Fig. HD2-3 — View of battery ignition breaker assembly.

1. Lock screw
2. Wire to coil
3. Eccentric adjusting screw
4. Fiber cam follower
5. Cam
6. Timing marks
7. Lock screw
8. Cap screw
9. To "Gen." terminal of voltage reg.
10. To "F" terminal of voltage reg.
11. Generator terminals
12. Condenser
13. Breaker points
14. Lock screw
15. Circuit breaker plate terminal

1. Circuit breaker
2. Ground terminal,
3. Junction terminal, for right side generator field coil wire
4. Junction terminal for left side generator field coil wire
5. Generator frame
6. Armature mounting screw
7. Lockwasher
8. Circuit breaker cam
9. Armature
10. Sprocket shaft key
11. Generator brush (4)
12. Clip (4)
13. Brush wire ground screw
14. Brush spring (4)
15. Brush spring insulator (4)
16. Field coil wire grommet
17. Pole shoe (6)
18. South field coil (3)
19. North field coil (3)

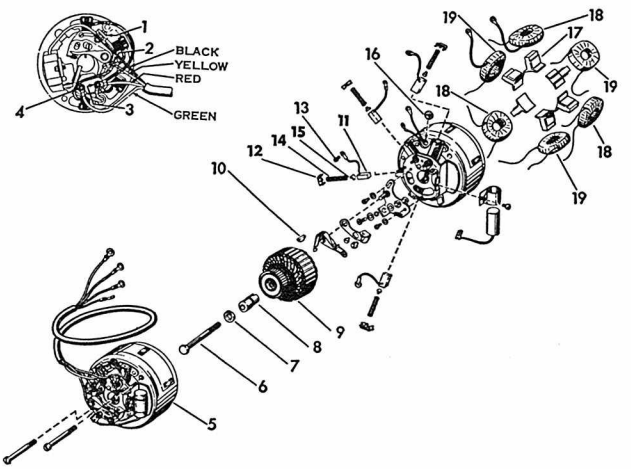


Fig.HD2-4—Exploded view of the generator and battery ignition unit on models 125 and 165.

MAGNETO AND TIMING. Hummer, Scat, Pacer, and Super-10 models are equipped with a rotating magnet type magneto. Ignition breaker points and lighting points are both located on the right side of the engine and are accessible after removing the inspection cover. Refer to Fig. HD2-5. (Ranger model does not have a lighting circuit.) Recommended gap for both sets of points is 0.018 inch. Gaps can be adjusted after loosening lock screws (4 & 5 or 4A & 5A). Retighten screws after gaps are set. To set the timing, first check and reset breaker point gap and place piston 7/32-inch BTDC. Crankshaft position is 31-33 degrees BTDC. Due to the angular position of spark plug hole in head of some models, it may be necessary

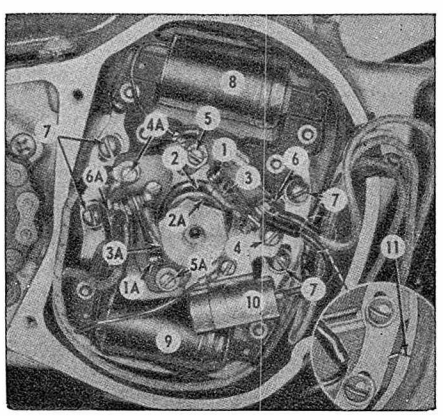


Fig. HD2-5—View of the magneto ignition and lighting breaker assembly.

1. Ignition breaker points
1A. Stop light breaker Points
2. Ignition breaker cam
2A. Stop light breaker cam
3 & 3A. Cam follower and oiler
4. Pivot screw
4A. Pivot screw (Ignition-stop light coil wire and spark coil wire connect here)
5 & 5A. Lock screw
6. Terminal (Condenser and spark coil wire connect here)
6A. Terminal (Stop light wire connects here)
7. Magneto-generator mounting screws
8. Lighting coil
9. Ignition and stop light coil
10. Condenser
11. Timing marks

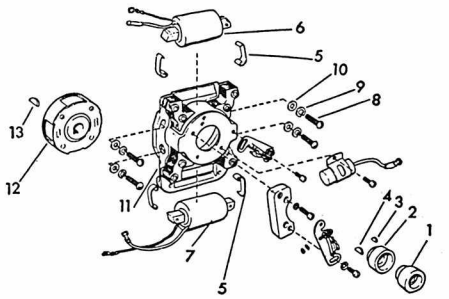


Fig. HD2-6—Exploded view of the magneto assembly used on Hummer, Super-10, Ranger, Pacer and Scat models.

1. Outer cam
2. Inner cam
3. Cam key
4. Cam key
5. Coil core clamp (4)
6. Headlamp and tail lamp coil
7. Ignition and stop lamp coil
8. Flange mounting screw (4)
9. Flange mounting screw lockwasher (4)
10. Flange mounting screw flat washer (4)
11. Flange
12. Rotor
13. Rotor key (See item 4)

to measure piston position with head removed. NOTE: If cylinder head is removed, secure cylinder using spacer collars (same thickness as cylinder head) on the head and cylinder retaining studs. Loosen the four screws (7—Fig. HD2-5) and shift the magneto base until ignition points just begin to open. Retighten screws (7). Shifting base in clockwise direction retards timing; counter-clockwise advances timing.

LUBRICATION. Engine lubrication is obtained by mixing 1 part Harley-Davidson two-cycle oil with 25 parts unleaded gasoline. Two fuel cap measurefuls should be used with each U.S. gallon of gas. Gear box and clutch require 1¼ pints of Harley-Davidson "75" medium heavy oil for normal service at temperatures above 32 degrees F,; and Harley-Davidson "58" special light oil for normal service at temperatures below 32 degrees F.

CLUTCH CONTROL. Clutch hand lever should have ⅛-¼ of its complete movement as free travel. To ad-

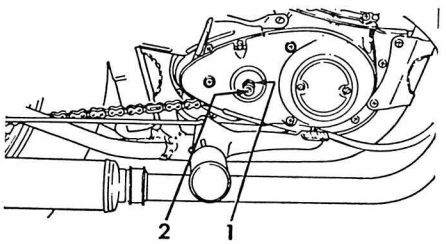


Fig. HD2-7—Clutch adjustment is accomplished by turning screw (2) after first loosening lock nut (1).

just the free travel, loosen lock nut (1—Fig. HD2-7) and turn adjusting screw (2) either way as required until the correct free travel is obtained.

REPAIR

Because of the close tolerance of the interior parts, cleanliness is of utmost importance. It is suggested that the exterior of the engine, gear box and all nearby areas be absolutely clean before any repair is started.

PISTON, RINGS AND CYLINDER. The two piston rings are identical with stepped ends and are pinned in the piston. Piston and rings are available in standard size as well as 0.005, 0.010, 0.020, 0.030 and 0.040 in. oversizes for all models. Models 125 and Hummer also have the additional piston and ring oversize of 0.050 in. available. The following specifications data is in inches.

Ring End Gap

125, 165, Hummer & Super 10 .....0.012-0.020

Ranger, Scat & Pacer ..0.008-0.019

Ring Side Clearance	Top Ring	Bottom Ring
125, 165 & Hummer	0.004-0.005	0.004-0.005
1960 Super 10	0.009-0.011	0.009-0.011
1961 Super 10	0.009-0.011	0.004-0.005
Ranger, Scat & Pacer	0.006-0.008	0.002-0.004

Piston Skirt to Cylinder Clearance (Right Angles to Pin) 0.0025-0.0035

Piston Pin to Piston Clearance at 70° F. .....0.0001 interference

Piston Pin to Rod Needle Bearing Clearance

Models So Equipped ..0.0002-0.0012 (Loose Fit)

Arrow on top of piston should point toward front of engine (exhaust port).

Seal cylinder head to cylinder block with aluminum paint on Super 10, Ranger, Pacer and Scat models. Install new cylinder head gasket on 165 and Hummer models. Use gasket sealer on both sides of gasket.

1. Oil seal screw and washer (3)
2. Oil seal
3. Oil seal gasket
4. Crankcase screws (11)
5. Generator-magneto shaft bearing
6. Right crankcase side
7. Flywheels and connecting rod assembly
8. Left crankcase side
9. Sprocket shaft bearing—inner
10. Sprocket shaft bearing-outer
11. Oil seal and retainer
12. Oil seal spring ring

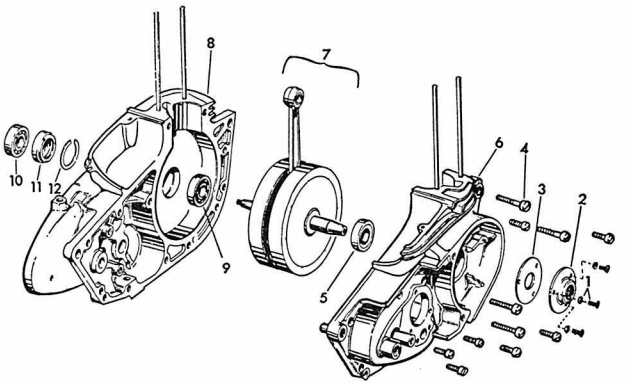


Fig. HD2-8—Exploded view of the engine crankcase. Refer to Fig. HD2-10 for an exploded view of the flywheel and connecting rod assembly.

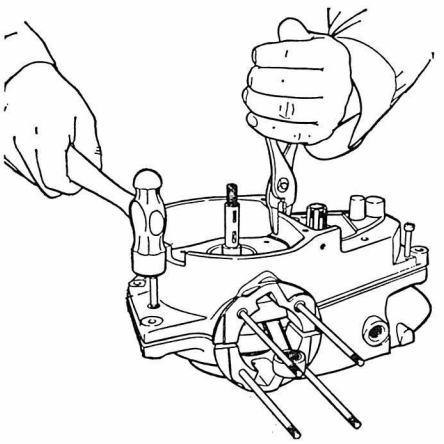


Fig. HD2-9—The crankcase halves can be separated as shown by using two long screws.

CONNECTING RODS AND CRANKSHAFT. To remove the connecting rod, crankshaft and flywheels assembly it is first necessary to remove the complete engine. Remove cylinder head, cylinder, generator or magneto. Remove the transmission mainshaft sprocket, oil seal, engine sprocket, front chain and clutch. Remove the starter mechanism. Remove seal (2—Fig. HD2-8) and screws (4). NOTE: On models 165, Super-10, Ranger, Pacer and Scat, all eleven screws (4) are located on right side; on Model 125 and Hummer, ten are on the right and one on the left. The crankcase can be separated as shown in Fig. HD2-9 by using two longer screws. It may be necessary to apply heat to right case half around the generator or magneto shaft bearing and both locating dowels.

To disassemble the flywheels, crankshaft and rod assembly, special Harley-Davidson tools are required and overhaul should not be attempted unless these tools are available.

CLUTCH. To disassemble the clutch unit, drain the transmission case oil and remove the shifter pedal (8—

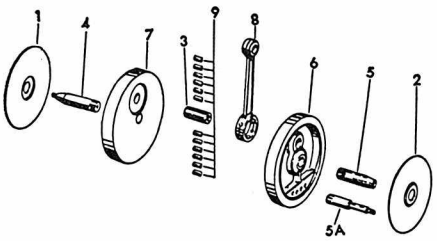


Fig. HD2-10—Exploded view of the flywheels, crankshaft and rod assembly.

1. Flywheel plate—left
2. Flywheel plate—right
3. Crankpin
4. Sprocket shaft
5. Generator shaft (models 125 & 165)
5A. Magneto shaft (Hummer & Super-10 models)
6. Flywheel—right
7. Flywheel—left
8. Connecting rod
9. Crankpin bearing rollers (12)

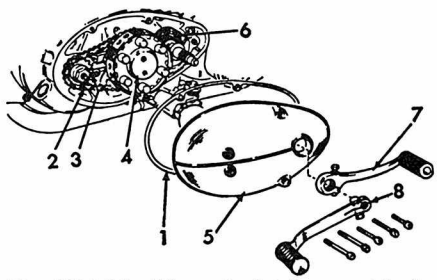


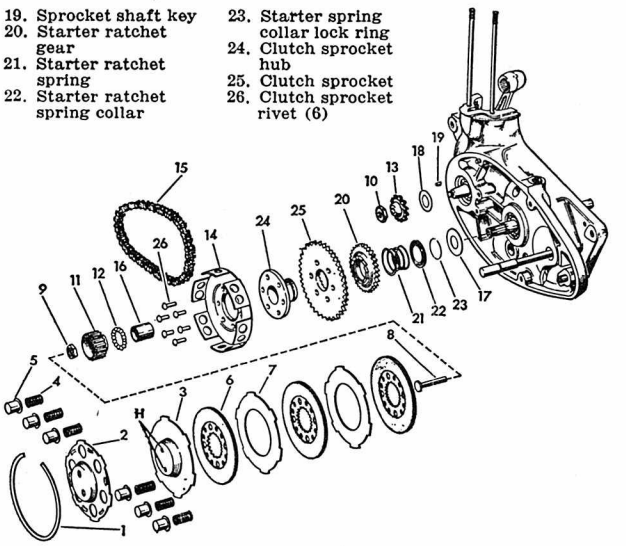
Fig. HD2-11—View of clutch assembly installed.

1. Clutch case cover gasket
2. Front drive chain
3. Engine sprocket
4. Clutch
5. Clutch case cover
6. Starter spring
7. Starter crank
8. Gear shifter pedal

Fig. HD2-11) and starter crank (7). Remove the five clutch case cover retaining screws; then, remove cover. Insert two clutch release disc studs (Harley-Davidson part No. 3790247) through holes in thrust plate (2—Fig. HD2-12) and turn them into the threaded holes (H) in release disc (3). Then turn two compression nuts (Harley-Davidson part No. 7675) on studs against plate (2) to compress springs. Remove snap ring (1) and withdraw thrust plate (2), release disc (3), springs (4) and cups (5) as a unit. Remove discs (6 & 7). Remove left release rod (8) and remove nuts (9 & 10). NOTE: Nut (9) has left hand threads; nut (10) has right hand

Fig. HD2-12 — Exploded view of the clutch assembly.

1. Snap ring
2. Clutch thrust plate
3. Clutch release disc
4. Clutch spring (6)
5. Clutch spring cup (6)
6. Clutch disc—with lining (3)
7. Clutch disc—steel (2)
8. Clutch release rod—left
9. Clutch hub nut
10. Engine sprocket nut
11. Clutch hub
12. Clutch steel ball (15)
13. Engine sprocket
14. Clutch shell
15. Front chain
16. Clutch bushing
17. Clutch bushing thrust washer
18. Sprocket shaft bearing shim—.007 in.
19. Sprocket shaft key
20. Starter ratchet gear
21. Starter ratchet spring
22. Starter ratchet spring collar
23. Starter spring collar lock ring
24. Clutch sprocket hub
25. Clutch sprocket
26. Clutch sprocket rivet (6)



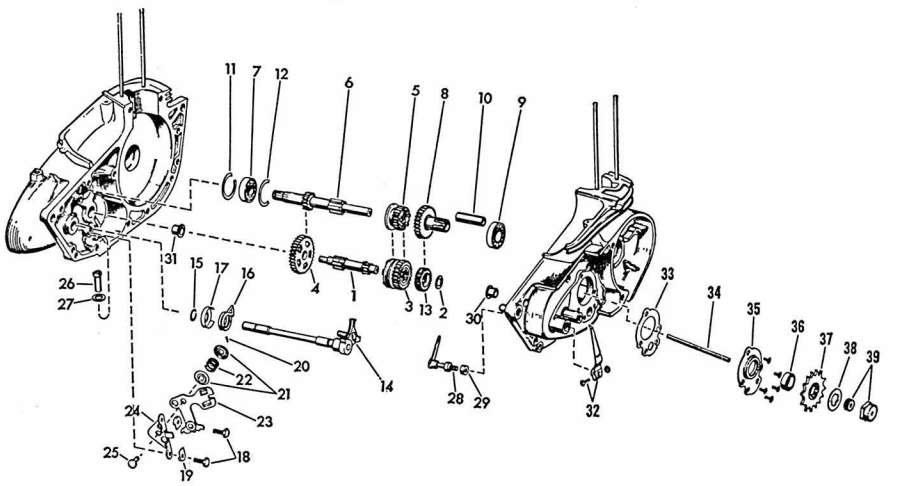


Fig. HD2-13—Exploded view of the transmission gears and shifter parts.

1. Countershaft
2. Countershaft high gear thrust washer
3. Countershaft sliding gear
4. Low gear
5. Mainshaft sliding gear
6. Mainshaft
7. Mainshaft ball bearing—left
8. Main drive gear
9. Main drive gear ball bearing
10. Main drive gear bushing
11. Mainshaft bearing spring ring—outer
12. Mainshaft bearing spring ring—inner
13. Countershaft gear
14. Gear shifter shaft
15. Pawl retaining clip
16. Shifter pawl spring
17. Shifter pawl
18. Ratchet bracket bolt (2)
19. Ratchet bracket bolt lock washer (2)
20. Ratchet spring key
21. Ratchet spring collar (2)
22. Ratchet spring
23. Gear shifter ratchet
24. Gear shifter ratchet bracket
25. Gear shifter ratchet spring pin
26. Ball retainer
27. Ball retainer washer
28. Gear indicator inner arm
29. Gear indicator inner arm oil seal
30. Countershaft bushing—right
31. Countershaft bushing—left

threads. Using suitable pullers remove engine sprocket (13) and clutch shell (14). NOTE: Take care to prevent damage or loss of the 15 loose balls (12).

Springs (4) should have a free length of 1-3/16 inches.

When reassembling, vary the number of 0.007 thick shims (18) until clearance between back side of engine sprocket and inner race of the ball bearing is 0.003-0.0012. Nut (9) should be torqued to 70 Ft.-Lbs. Readjust clutch as outlined previously.

GEAR BOX. To disassemble the gear box it is first necessary to remove the right half of the crankcase. Disassembly will be evident after examining unit and reference to Fig. HD2-13.

Ball bearings (7 & 9) should have a 0.0005 loose to 0.0005 tight fit in crankcase bores; 0.0001 loose to 0.0005 tight fit on shaft. Drive gear (8) should have an 0.001-0.0025 loose fit on shaft. Main shaft should not have more than 0.022 end play. Countershaft (1) should have 0.0005-0.0015 diametral clearance in bushings (30 & 31). A reamer (Harley-Davidson part No. 95924-48) should be used to size bushings. Low gear (4) should have 0.0007-0.0022 clearance on shaft.

HODAKA

PACIFIC BASIN TRADING CO.
(PABATCO)
Box 327
Athena, Oregon 97813

90 AND 100 CC MODELS

MODEL	Ace 90	Ace 100 100 B	Super Rat (100 MX)
Displacement-cc	90	98	98
Bore-MM	48	50	50
Stroke-MM	50	50	50
Number of cylinders	1	1	1
Oil-fuel ratio	1 to 20	1 to 20	1 to 16
Plug gap-inch	0.024-0.027	0.024-0.027	0.016-0.020
Point gap-inch	0.012-0.015	0.012-0.015	0.012-0.015
Ignition timing	Fixed	Fixed	Fixed
Degree BTDC	25	25	25
Electrical system voltage	6	6	....
Battery terminal grounded	Negative	Negative	....
Tire size-front	2.50 X 17	2.75x17*	3.00x19
rear	2.75 X 17	3.00x17*	3.25x18
Tire pressure psi-front	22	22	22
rear	25	25	24
Rear chain free play-inch	¾	¾	¾
Number of speeds	4	5	5
Weight-lbs. (Approx.)	155	170	169

*100 B models are equipped with a 2.75x19 front tire and a 3.00x18 rear tire.

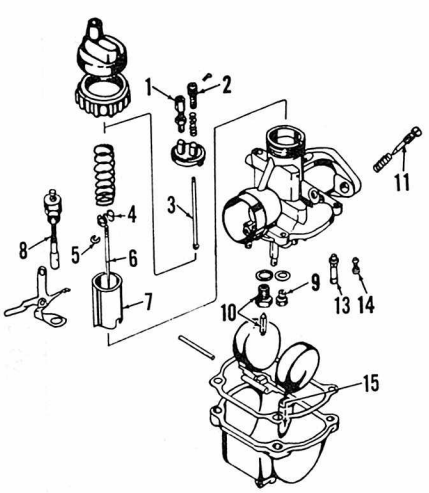


Fig. HK1—Exploded view of Mikuni carburetor used on Hodaka Ace 90. Make certain clip retainer (4) is installed.

1. Throttle cable end
2. Idle speed adjuster
3. Idle speed adjuster rod
4. Retainer
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Inlet valve
11. Idle mixture needle
13. Needle jet
14. Pilot jet
15. Starter jet

MAINTENANCE

SPARK PLUG. Recommended spark is NGK type B-7 for 90 cc and a B-8 for 100 cc street versions. An NGK type B-10HN with an electrode gap of 0.018 inch is recommended for use in 100/MX engines. All others should have an electrode gap of 0.024-0.027 inch.

CARBURETOR. The carburetor used on street models is a Mikuni VM-20-SH3 as shown in Fig. HK1. Idle mixture screw (11) controls air flow and richens the idle mixture when turned in. Normal position of idle mixture screw is 1¼ turns open. Screw (2) increases idle speed when turned counter-clockwise. Normal position of clip (5) is third groove from top of needle (6), on 90 cc engines and fourth groove from top on 100 cc engines. Installation of clip in lower groove richens mixture in intermediate range. Standard main jet (9) size is 85 on 90 cc models and 95 on 100 cc models. Distance from float to gasket surface of carburetor body should be ⅞ inch.

A Mikuni 24 MM carburetor is used on 100/MX models. Refer to Fig. HK2

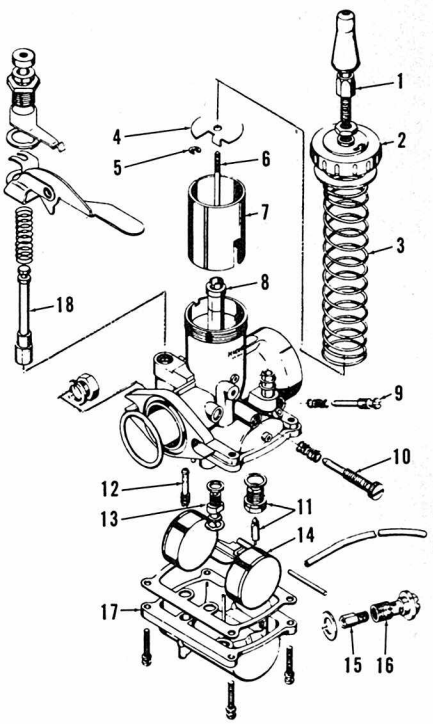


Fig. HK2—Exploded view of 24 MM carburetor used in the 100/MX "Super Rat" engine.

1. Throttle cable adjuster
2. Mixing chamber cap
3. Throttle return spring
4. Cable seat
5. Jet needle clip
6. Jet needle
7. Throttle slide
8. Needle jet
9. Idle air screw
10. Throttle adjusting screw
11. Float valve
12. Pilot jet
13. Needle jet retainer
14. Float
15. Main jet
16. Main jet holder
17. Float chamber
18. Starter plunger

for exploded view. Standard main jet (15) is #220. Clip (5) in third groove from top of needle (6) and air screw (9) should be 1¼ turns out from a lightly seated position initially. Distance from float to gasket surface of carburetor body should be 1-inch with valve (11) closed.

IGNITION AND ELECTRICAL. A flywheel type magneto is used and coils for ignition and lighting are contained under the flywheel. Ignition point gap should be 0.012-0.015 in. Ignition timing should occur at 25 degrees BTDC and can be corrected a small amount by changing the point gap within the allowed limits. When

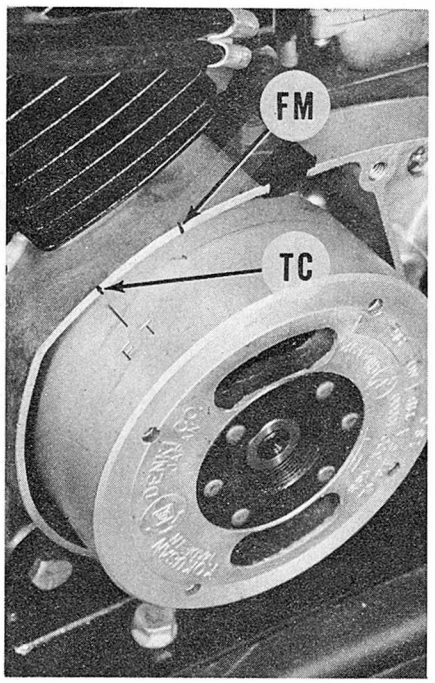


Fig. HK3 — When mark on flywheel is aligned with first mark (FM) on crankcase, crankshaft is at 25 degrees BTDC. Top center mark is shown at TC.

mark on flywheel is aligned with first mark on crankcase as shown in Fig. HK3, crankshaft is 25 degrees BTDC. Second mark on crankcase is top center. Flywheel nut should be torqued to 132-167 inch pounds.

LUBRICATION. Engine is lubricated by mixing SAE 30 two stroke motor oil with the fuel. Normal ratio for street use is 1:20 and a ratio of 1:16 is recommended for competition. The gear box and clutch is lubricated by 1¼ pints SAE 30 motor oil. Gear box oil should be maintained at top mark on filler plug dipstick.

CLUTCH. The clutch, located on right side of engine, is of the multiple disc, wet type. The hand lever should have approximately ¼-inch free play as shown at B—Fig. HK5. Adjustment is accomplished at both ends of clutch cable. Further clutch adjustment is accomplished by adding or subtracting washers (16-Fig. HK6).

Refer to Fig. HK6 for exploded view of clutch assembly. Clutch friction discs (8) should be renewed if less than 0.067 in. (1.7 MM) thick. Clutch springs (12) should have a free length of 0.79 in. (20 MM) and inner springs (13) a free length of 0.67 in. (17 MM). Clutch retaining nut is left hand thread and should be torqued to 180 inch pounds.

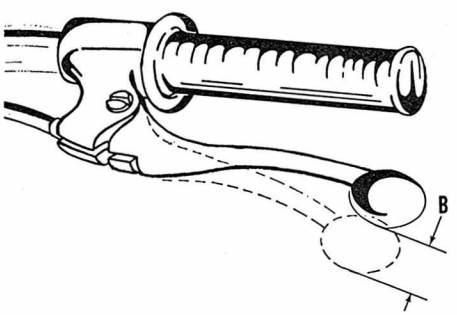


Fig. HK5 — Clutch lever should have ¼ inch free play as measured at B.

1. Thrust washer
2. Bushing
3. Crankshaft gear
4. Screws (6 used)
5. Clutch hub
6. Cover plate
7. Drum
8. Friction discs (3 used)
9. Drive plates (2 used)
10. Thrust washer
11. Pressure plate
12. Outer springs (6 used)
13. Inner springs (6 used)
14. Cover
15. Lock washer
16. Adjusting shims
17. Release bearing
18. Release plug
19. Seal
20. Clutch lever

Fig. HK6—Exploded view of clutch and cover assembly used on early models. Later models are similar, with the addition of one screw (4) and one more set of springs (12 & 13). Diameter is also increased on later clutch.

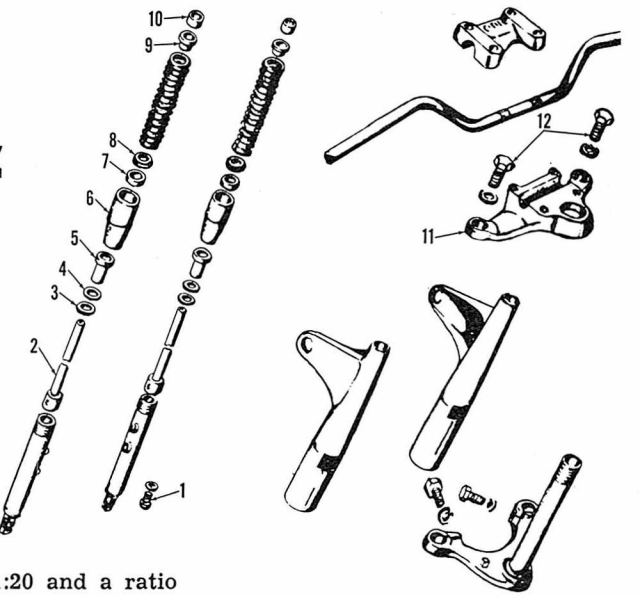


Fig. HK7—Exploded view of front suspension system used on early models.

1. Drain plug
2. Inner tube
3. Snap ring
4. O ring
5. Bushing
6. Nut
7. Seal
8. Spring seat
9. Spring seat
10. Seal
11. Top plate
12. Filler screws

SUSPENSION. Exploded view of early front suspension is shown in Fig.

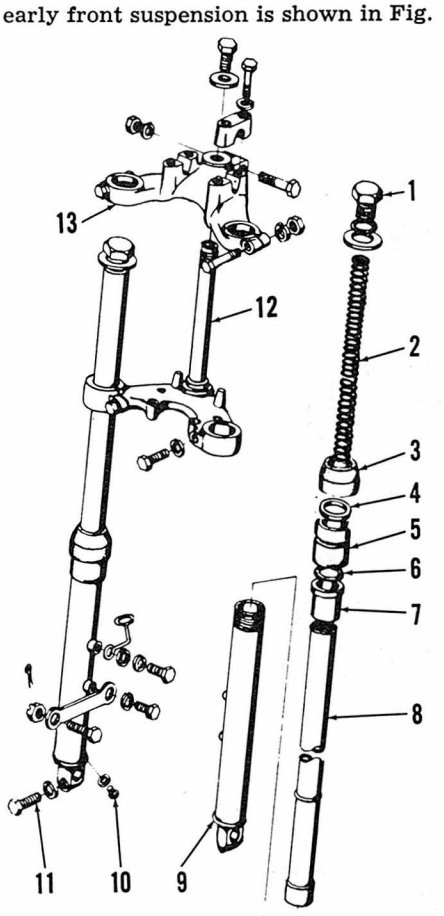


Fig. HK7A—Exploded view of front suspension system used on 100/MX versions. Late 100 cc units are similar.

1. Fork top bolt
2. Fork inner spring
3. Dust cover
4. Oil seal
5. Outer tube nut
6. "O" ring
7. Slider
8. Inner fork tube
9. Outer fork tube
10. Oil drain plug
11. Axle pinch bolt
12. Steering stem
13. Fork crown

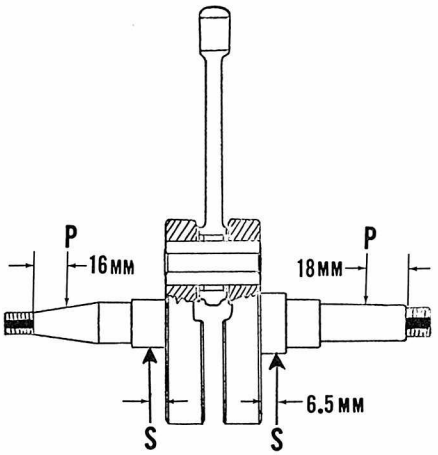
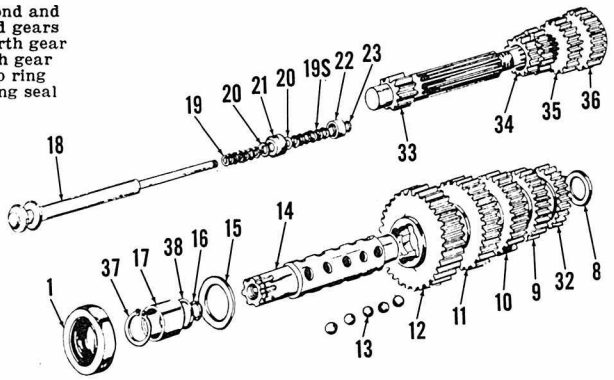


Fig. HK8—Crankshaft eccentricity is measured at points (P). Crankshaft should be supported at points (S).



1. Oil seal
8. Spacer (right side)
9. Fourth gear
10. Third gear
11. Second gear
12. First gear
13. Shift balls (20 used)
14. Output shaft
15. Spacer (left side)
16. O ring
17. Collar
18. Shift rod
19. Spring (left side)
20. Washers
21. Shift ball receiver
22. Collar
23. Snap ring
32. Fifth gear
33. Cluster shaft and first gear
34. Second and third gears
35. Fourth gear
36. Fifth gear
37. Snap ring
38. O ring seal

Fig. HK11—Exploded view of five speed close ratio transmission gears. On wide ratio transmission, first and second gears are part of cluster shaft (33) and other three gears are pressed on and not splined.

HK7. Each suspension unit contains 4.5 ounces (135cc) of oil. Units on later models (Fig. HK7A) contain 150cc of oil each. Oil used should be 30% SAE 30 and 70% SAE 70 oil. Rear suspension units are not repairable.

REPAIRS

PISTON, RINGS AND CYLINDER. The piston can be removed after the exhaust pipe, carburetor, cylinder head and cylinder are removed.

Piston skirt to cylinder clearance .....0.003-0.004 inch (0.07-0.1 MM)

Limit .....0.006 inch (0.15 MM)

Ring end gap—

Top .....0.006-0.014 inch (0.15-0.36 MM)

Second .....0.004-0.012 inch (0.1-0.3 MM)

Ring side clearance .0.0008-0.0024 inch (0.02-0.06 MM)

Maximum cylinder taper or out of round .....0.004 inch (0.1 MM)

Pistons are available in standard and four oversizes. Pistons should be installed with arrow on dome toward front (exhaust side) of engine. Torque head retaining nuts to 88-105 inch pounds.

Piston pin is full floating type and is retained in piston with snap rings. Piston pin bushing in upper end of connecting rod should have oil slot open. Bushing should be renewed if there is evidence of turning in rod. Later 100cc models are equipped with needle bearing in small end of rod. Bearing should be renewed if wear is evident.

CONNECTING ROD AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Connecting rod, crankpin and roller bearings are removed by pressing crankshaft apart. Crankshaft should be disassembled ONLY if required tools are available to correctly check and align the reassembled crankshaft. Maximum eccentricity allowed when checked at points (P—Fig. HK8) is 0.0008 in. (0.02 MM). Crankshaft should be supported at points (S) located 0.256 in (6.5 MM) from faces of crankshaft counterweights. Connecting rod should have 0.002-0.004 in. (0.05-0.10 MM) side play on crankpin. Crankshaft counterweights should be 1.5621-1.5700 in. (39.8-40.0 MM) between outside faces.

CRANKCASE AND GEAR BOX. To disassemble the crankcase and gear box, the engine must first be removed. Remove the cylinder head, cylinder, piston, flywheel, magneto, clutch cover and clutch. Remove screws that hold crankcase halves together and carefully separate the halves. Dowel pins are installed between the halves. Be careful not to damage sealing surfaces of crankcase. Four speed transmission parts are shown in Fig. HK10.

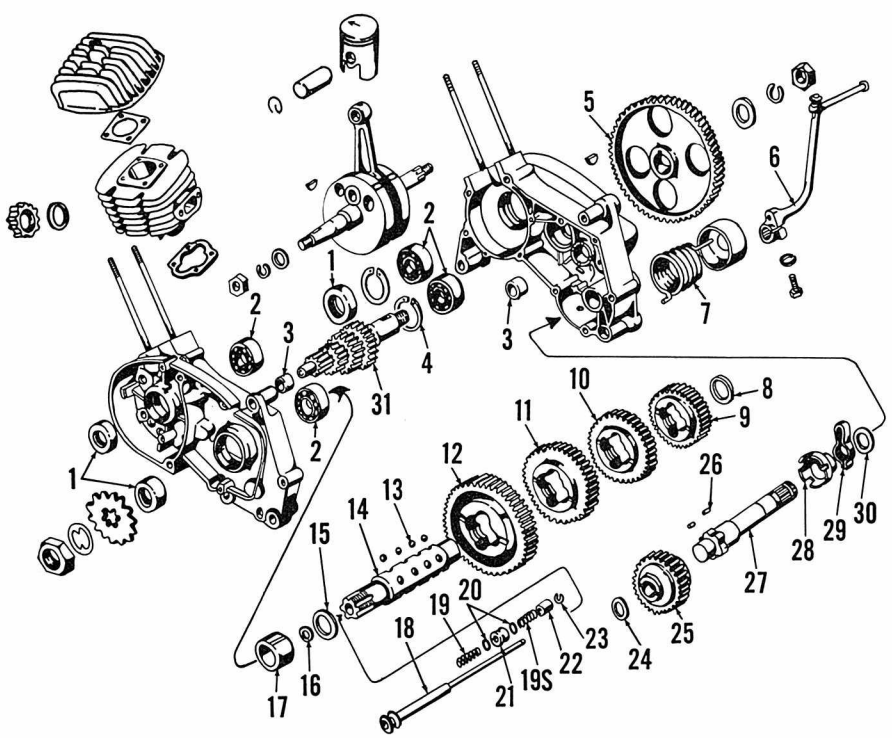


Fig. HK10—Exploded view of the crankcase and four speed transmission assembly. Refer to Fig. HK11 for five speed transmission.

1. Seals
2. Ball bearings
3. Bushing
4. Snap rings
5. Transmission input gear
6. Kickstarter lever
7. Return spring
8. Spacer
9. Fourth gear
10. Third gear
11. Second gear
12. First gear
13. Shift balls (16 used)
14. Output shaft
15. Spacer
16. O ring seal
17. Collar
18. Shift rod
19. Long spring
19S. Short spring
20. Washers
21. Shift ball receiver
22. Collar
23. Snap ring
24. Shim washer
25. Starter gear
26. Starter rollers (5 used)
27. Starter shaft
28. Roller retainer
29. Retainer brake
30. Shim washer
31. Input cluster gear

Wide and close ratio, five speed gear sets are available as shown in Fig. HK 11. On close ratio gears, first gear is part of cluster shaft (33) and other gears are splined to shaft. On wide ratio gears, first and second gears are part of cluster shaft and other gears are a tight press fit on shaft. On all models, shoulder on cluster gears (34, 35 & 36) should be toward right (primary drive) side. The output shaft (14), gears (9, 10, 11, 12 & 32), shift spool (18 through 23) and shift balls (13) are similar to four speed transmission with the addition of four shift balls and fifth speed gear. When assembling, shoulders on gears (9, 10, 11, 12 & 32) should be toward left (sprocket) end of shaft (14).

On all (four & five speed) transmissions, spring (19—Fig. HK 10 and HK 11) is left hand wound and spring (19S) is right hand wound. Transmission output shaft (14) should have 0.010 inch end play. The kick starter shaft (27—Fig. HK 10) should have 0.002-0.004 inch end play. The shift shaft in the left side cover should have 0.008-0.012 inch end play.

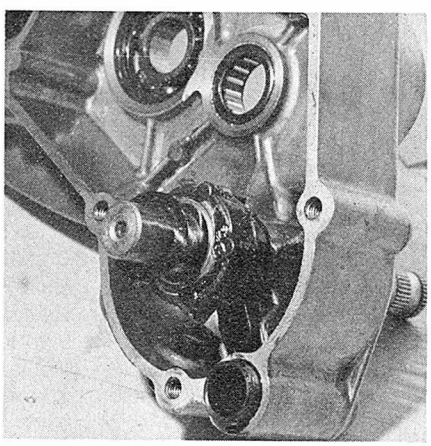


Fig. HK12 — Kickstarter rollers may be held in place with grease to aid installation of gear (25—Fig. HK10).

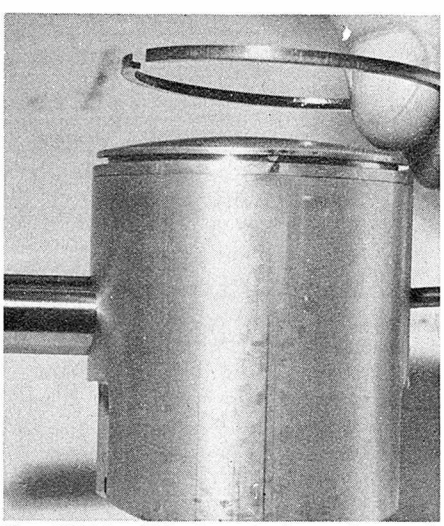


Fig. HKT-1—"L" shaped piston ring used in Super Rat. Ring is designed to provide maximum compression sealing and minimum friction.

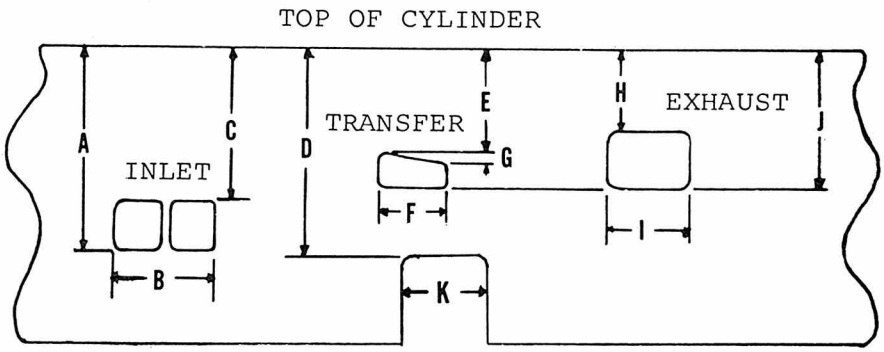


Fig. HKT-2—Diagram of cylinder ports of Hodaka engine. Refer to text for various modifications that are recommended.

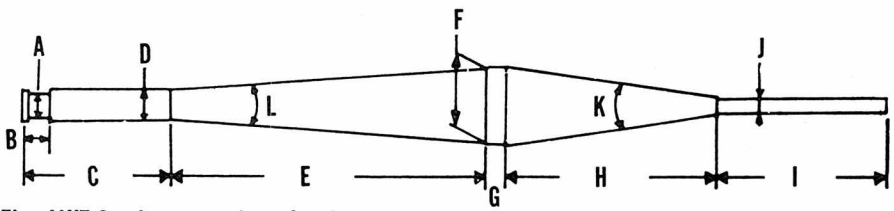


Fig. HKT-3—An expansion chamber is necessary to extract maximum performance from a two cycle engine. Various configurations are outlined in the text.

SPEED TUNING

The 100/MX (Super Rat) is the competition version of the 100 B. Many design features of 100/MX may be incorporated in a stock 100cc engine. Higher compression head, larger carburetor, expansion chamber and other performance parts are available through the manufacturer and distributors. Any modifications will void manufacturers warranty.

SPARK PLUG. NGK racing type plugs are recommended. A normal heat range for a competition prepared Hodaka is a type B-10HN.

CARBURETOR. The 24 MM unit used on 100/MX models may be used to improve performance on standard 100 cc versions and a 22 MM carburetor is available for use on 90 cc models. A 22 MM carburetor used on a 100 cc engine will provide better low RPM response but lack high speed power.

For very high speed use (road racing) an Amal GP-2 ($1\frac{5}{32}$ inch bore) has proven a worthwhile modification. The following jet sizes are recommended:

Main jet .....#300-370
Needle jet .....#107
Throttle slide 5½
Pilot jet .....#30
Air jet .....#125

Jet needle clip should be in second groove from top of needle.

Recommended carburetor for flat track or "TT" racing is an Amal Monobloc with a $1\frac{3}{16}$ inch venturi. The following jet sizes are recommended:

Main jet .....#300-400
Throttle slide 4½
Jet Needle .....D
Clip position .....2nd groove
Needle jet .....#109
Pilot jet .....#20

An adapter is available from Hodaka to mount Amal carburetors.

IGNITION. Ignition should occur when piston is 0.114 inch BTDC (25 degrees BTDC). Point gap should be at 0.012 inch. Engines prepared for road racing with the special high speed point cam and total loss battery ignition should have point gap set at 0.010 inch.

LUBRICATION. A 16:1 fuel to oil mixture should be used in competition. Oil used should be type intended for use in two cycle air cooled engines only.

CYLINDER, PISTON AND HEAD. A 12:1 high compression head is available.

Piston used in competition version has only one "L" shaped ring (See Fig. HKT 1). If engine is intended for road racing, cut 0.040 inch from skirt on intake side of piston.

Cylinder porting and expansion chamber specifications will determine the power characteristics of the engine more than anything else.

If the engine is to be used in **flat track, "TT" or road racing,** the following port and chamber specifications should be used. Hodaka has recommended these specifications for maximum RPM gain. All dimensions are in inches.

High Speed Tune Cylinder (Refer to Fig. HKT 2)

A. 2.969	F. 0.937
B. 1.406	G. 0.062
C. Stock	H. 1.062
D. 2.969	I. 1.156
E. 1.469	J. Stock

High Speed Tune Expansion Chamber (Refer to Fig. HKT 3)

A. 1.16	
B. 1.18	F. 3.375
C. 9.0	G. 2.406
D. 1.375	H. 8.531
E. 15.9375	I. 4.0
	J. 1.062

If engine is to be used for **Moto-Cross** or **rough scrambles**, the following porting and chamber specifications will yield more torque and less RPM.

High Torque Cylinder (Refer to Fig. HTK 2)

A. 2.9	F. Stock
B. 1.42	G. 0.059
C. 2.2	H. 1.18
D. Stock	I. 1.14
E. 1.52	J. 2.0

High Torque Expansion chamber (Refer to Fig. HKT 3)

A. 1.16	G. 0.87
B. 1.18	H. 9.85
C. 6.89	I. 7.87
D. 1.28	J. 0.87
E. 14.5	K. 15 degrees
F. 3.4	L. 8 degrees

CRANKSHAFT AND CONNECTING ROD. Crankshaft eccentricity should be kept to a minimum. Connecting rod should be bladed and polished and side clearance set at 0.010 inch if engine is to be used for road racing.

TRANSMISSION. Wide and close ratio gear sets are available as well as straight cut primary gears.

KAWASAKI

AMERICAN KAWASAKI MOTORCYCLE CORP.
1062 McGaw Ave.
Santa Ana, Calif. 92705

J1, D1 AND C2 MODELS

MODEL	J1, J1T & J1TR	J1L, J1TL & J1TRL	D1	C2SS & C2TR
Displacement-cc	81.5	81.5	99	115
Bore-MM	47	47	52	53
Stroke-MM	47	47	47	52.5
Number of cylinders	1	1	1	1
Oil-fuel ratio	1 to 20	Oil injection	Oil injection	Oil injection
Plug gap-inch	0.024-0.028	0.024-0.028	0.024	0.024
Point gap-inch	0.012-0.016	0.012-0.016	0.012-0.016	0.012-0.016
Ignition timing-Advance	Fixed	Fixed	Fixed	Fixed
Degrees BTDC	19	19	19	19
Electrical system voltage	6	6	6	6
Tire size-front	2.50x17	2.50x17	2.50x17	2.50x18
Rear	*2.50x17	*2.50x17	2.50x17	2.75x18
Tire pressure-front	22	22	22	22
Rear	28	28	28	28
Rear chain free play-inch	¾	¾	¾	1
Number of speeds	4	4	4	4
Weight-Lbs. (Approx.)	**168	**168	174	***179

*J1TR and J1TRL rear tire size is 2.75x17
**J1TR and J1TRL is 176 pounds
***C2TR is 185 pounds

MAINTENANCE

SPARK PLUG. Recommended spark plug electrode gap is 0.6MM (0.024 inch). Refer to the following for recommended spark plug:

MODEL	CHAMPION	NGK
J1, J1T, J1L & J1TL	L-7	B-7H
J1TR & J1TRL	L-5	B-7HZ
D1	L-7	B-7H
C2SS & C2TR	L-5	B-7HZ

CARBURETOR. A Mikuni VM17SC carburetor is used on J1 and D1 models, VM18SC is used on C2 models. Fig. K1-1 shows idle speed (2) and idle mixture (11) adjustment points. Normal setting is 1½ turns open. Clip (5) should be installed in third groove from top of needle (6). Float level (H—Fig. K1-2) should be 18MM (21/32-¾ inch) and is adjusted by bending tang (17) on float. Refer to Fig. K1-1 and the following for recommended jet sizes.

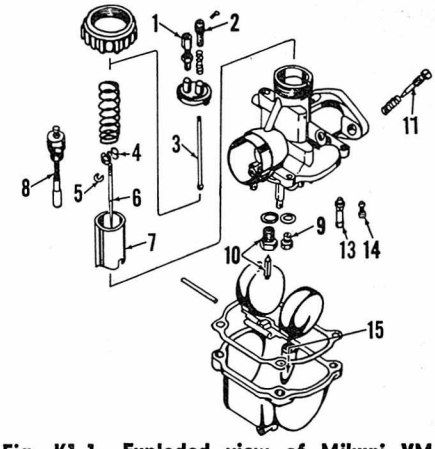


Fig. K1-1—Exploded view of Mikuni VM carburetor typical of type used.

1. Throttle cable adjuster
2. Idle speed adjuster
3. Idle speed rod
4. Spring seat
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Fuel inlet valve
11. Idle mixture needle
13. Needle jet
14. Pilot jet
15. Starter jet

J1

Main jet (9)	110
Needle jet (13)	E-2
Pilot jet (14)	20

D1

Main jet (9)	150
Needle jet (13)	E-2
Pilot jet (14)	15

C2

Main jet (9)	170
Needle jet (13)	E-6
Pilot jet (14)	17.5

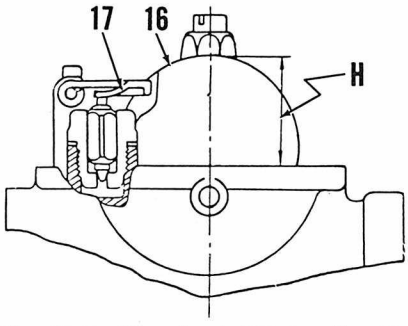


Fig. K1-2—Float level (H) is adjusted by bending tang (17).

IGNITION AND ELECTRICAL. A flywheel type magneto is used with low tension ignition coil and lighting coil contained under the flywheel.

Ignition timing is adjusted by changing the breaker point gap. Ignition timing marks are provided in two places. Mark (G—Fig. K1-3) can be used, without removing the engine left side cover, by aligning mark (G) with edge of coil core (H). With the engine left side cover removed, timing marks (B & C) should be aligned.

Ignition should occur (breaker points just open) at 19° BTDC for all models. If timing marks are not clearly visible, piston can be set at 0.062 inch BTDC on J1 and D1 models or 0.070 inch BTDC on C2 models.

To set the ignition timing, align timing marks and set the breaker point gap so that points just begin to open. Breaker point maximum gap should be within limits of 0.012-0.016 inch after timing is set. Magneto stator plate is not movable.

Ignition high tension coil is located inside of frame under the fuel tank.

LUBRICATION. On early 81.5cc models (J1, J1T & J1TR), the engine is lubricated by mixing SAE 30 two stroke oil with the fuel. Normal oil to gasoline ratio is 1:20. Later models (J1L, J1TL, J1TRL, D1, C2SS & C2TR) are equipped with an automatic oil injection ("Superlube") system. On models with "Superlube" oil injection, refer to the following OIL INJECTION section.

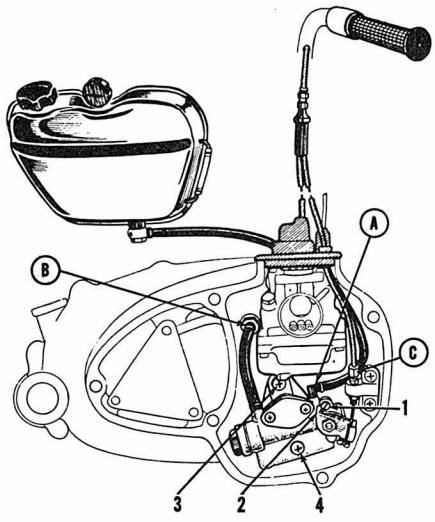


Fig. K1-4—Drawing of "SUPERLUBE" oil injection. Refer to text for adjusting.

A. Inlet line
B. Outlet line check valve
C. Cable adjuster
1. Screw
2. Control arm
3 & 4. Mounting screws

The gear box and clutch is lubricated by 1.2 pints SAE 30 motor oil. Gear box oil should be maintained between the two marks on filler plug dipstick when the filler plug is screwed in. Oil should be changed after the first 300 miles and every 1800 miles thereafter.

"SUPERLUBE" OIL INJECTION. The oil injection system automatically meters and pumps oil from a separate tank to the rotary valve cover plate. The oil tank should be filled with two stroke motor oil and **should never be allowed to run dry.**

If the system is drained or the pump unit is renewed, air should be bled from the system before engine is started. Allow oil to flow from inlet line (A—Fig. K1-4) before attaching to pump inlet connection. Disconnect outlet oil line (B) at the check valve on rotary valve cover, then operate kick starter with key turned off and throttle open until the outlet line is full of oil. Reconnect oil line to check valve.

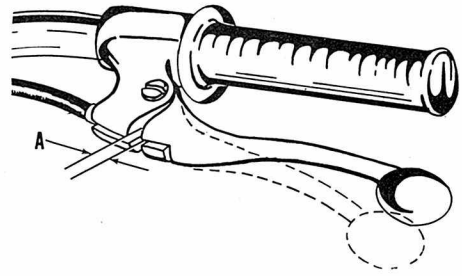
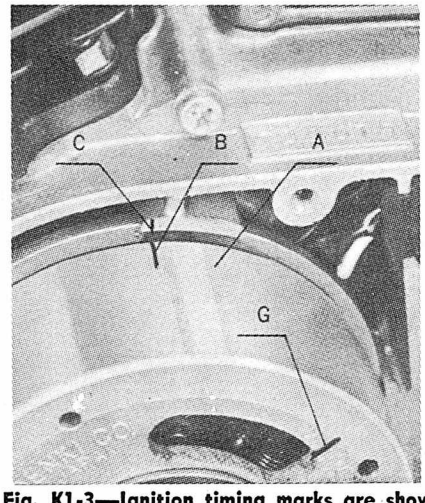


Fig. K1-6—Clutch hand lever free play is measured at A.

To adjust the pump control cable, turn the throttle grip to idle position and check to make certain that throttle cable does not have any free play. Throttle cable free play should be removed by turning cable adjuster (1—Fig. K1-1) but make certain that throttle is not partially open. Turn the pump cable adjuster (C—Fig. K1-4) until clearance between screw (1) and control arm (2) is 0.35MM (0.014 inch). After cable adjusters are correctly set, tighten lock nuts.

To remove the oil pump, it is necessary to remove the carburetor, kick starter pedal and the clutch (engine right side) cover. The pump can be removed after removing the drive gear (inside the clutch cover) and the two mounting screws (3 & 4—Fig. K1-4).

CLUTCH CONTROLS. The clutch is located on right end of transmission input shaft. The hand lever should have 2-3 MM (0.08-0.12 in.) free play as measured at (A—Fig. K1-6). Ad-



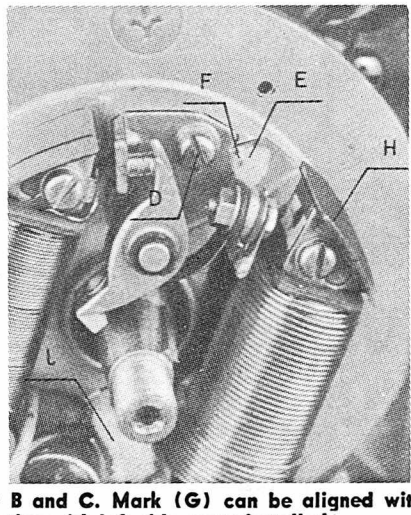


Fig. K1-3—Ignition timing marks are shown at B and C. Mark (G) can be aligned with edge of ignition coil core (H) for adjusting with left side cover installed.

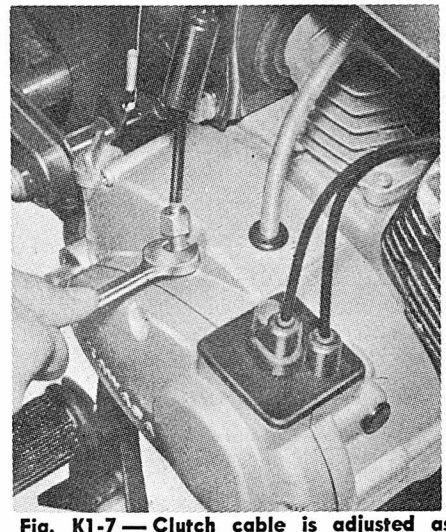


Fig. K1-7 — Clutch cable is adjusted as shown. Make certain lock nut is tightened after adjustment is complete.

justment is accomplished by first loosening the cable adjuster lock nut (Fig. K1-7), then removing right (carburetor) cover. Turn adjusting screw in, as shown in Fig. K1-8, until slight resistance is felt. DO NOT FORCE. Back screw out ¼-turn and tighten lock nut. Adjust cable (Fig. K1-7) until hand lever has 2-3 MM (0.08-0.12 in.) free play as shown in Fig. K1-6.

SUSPENSION. On J1 and D1 models, each front suspension unit contains 135cc of oil. Oil used should be 60% SAE 30 and 40% SAE 60.

On C2 models, each front suspension unit contains 175cc of oil. Oil used should be 80% SAE 30 and 20% SAE 60.

On all models, front suspension is drained at screw (1—Fig. K1-9) and filled at screw (2).

Rear suspension units are not repairable and should be renewed if leaking, bent or damaged.

REPAIRS

PISTON, RINGS AND CYLINDER. The piston can be removed after removing the exhaust pipe, cylinder head and cylinder. Refer to the following specifications.

J1

Ring end gap .....0.15-0.40 MM
0.006-0.016 in.
wear limit .....0.7 MM
0.028 in.
Piston pin diameter .13.994-14.0 MM
0.551 in.
wear limit .....13.95 MM
0.549 in.
Standard cylinder bore
diameter .....47.0-47.016 MM
1.850-1.851 in.
Piston skirt to cylinder
Clearance 0.004-0.040MM
0.00016-0.0016 in.
wear limit .....0.2 MM
0.008 in.

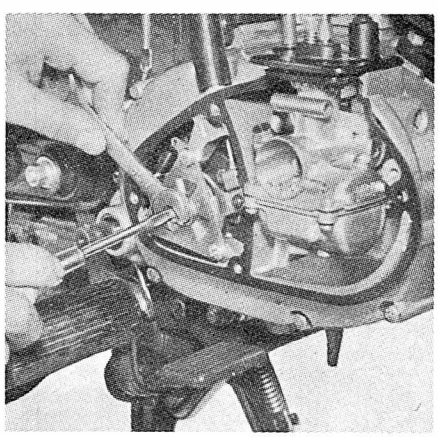


Fig. K1-8—When adjusting clutch, loosen adjuster screw ¼-turn from point of resistance.

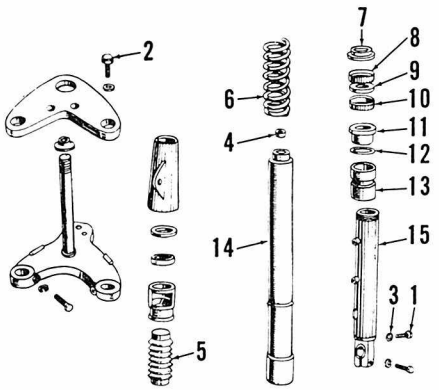


Fig. K1-9—Exploded view of typical front suspension unit.

1. Drain plug
2. Filler screw
3. Seal
4. Seal
5. Dust cover
6. Spring
7. Spring seat
8. Dust shield
9. Oil seal washer
10. Oil seal
11. Bushing
12. "O" ring
13. Tube nut
14. Inner tube
15. Outer tube

D1

Ring end gap 0.15-0.030MM
0.006-0.012 in.
wear limit 0.7MM
0.028 in.
Piston pin diameter ..13.994-14.0MM
0.551 in.
wear limit 13.95MM
0.549 in.
Standard cylinder bore
diameter 52.0-52.016MM
2.047-2.048 in.
Piston skirt to cylinder
clearance 0.004-0.040MM
0.00016-0.0016 in.
wear limit 0.2MM
0.008 in.

C2

Ring end gap 0.15-0.30MM
0.006-0.012 in.
wear limit 0.7MM
0.028 in.
Piston pin diameter ..14.994-15.0MM
0.590 in.
wear limit 14.95MM
0.589 in.
Standard cylinder bore
diameter 53.0-53.02MM
2.087-2.086 in.
Piston skirt to cylinder
clearance 0.004-0.040MM
0.00016-0.0016 in.
wear limit 0.15MM
0.006 in.

Piston skirt clearance should be measured at right angles to piston pin.

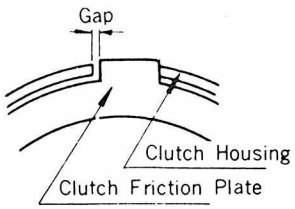


Fig. K1-13—Gap between clutch housing (3—Fig. K1-12) and friction plates (7) should be (0.0016-0.012 in.).

Chrome plated piston ring should be installed in top groove. Rings should be installed with manufacturers' marks toward top of piston. Piston must be installed with arrow on top aimed toward exhaust (front) port. Piston should be heated to approximately 250 degrees F before piston pin is installed. Cylinder and head retaining nuts should be tightened to 70-86 inch pounds torque.

CONNECTING ROD AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. The crankshaft, connecting rod, crankpin and crankpin bearing are available only as a unit. Connecting rod side play should be 0.25-0.30 MM (0.010-0.012 in.). Vertical movement of connecting rod should be less than 0.2 MM (0.008 in.).

CLUTCH. The multiple disc, wet type clutch is mounted on the right end of the transmission input shaft. Clutch springs (11—Fig. K1-12) have 24.8 MM (0.976 in.) free length and should be renewed if less than 23MM (0.906 in.) on J1 and D1 models. On C2 models, clutch spring free length should be 21.6MM (0.850 in.) and should be renewed if less than 20MM (0.787 in.) On all models, friction discs (7) should be 3.7MM (0.146 in.) thick and should be renewed if less than 3.35 MM (0.132 in.). Gap between drum and lugs on friction discs (Fig. K1-13) should be 0.04-0.30 MM (0.0016-0.012 in.). Renew clutch drum (3—Fig. K1-12) and/or friction discs (7) if clearance is excessive or drum is grooved. Shock dampers (9) should not be hard or worn.

CRANKCASE AND GEAR BOX. The rotary valve, located on right end of crankshaft, can be removed after removing carburetor, clutch, crank-

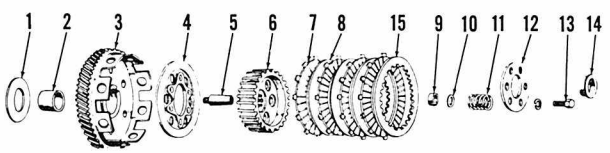
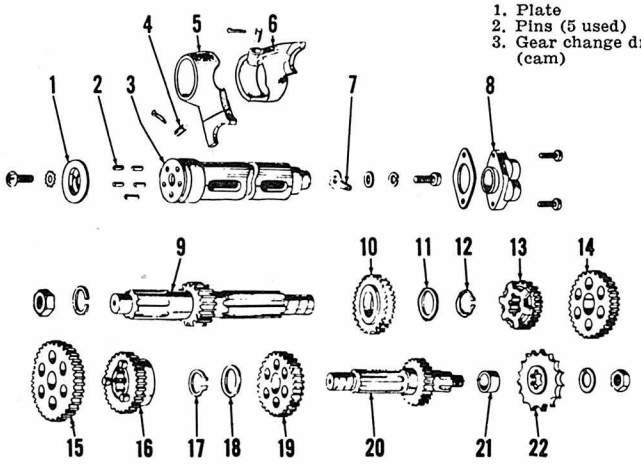


Fig. K1-12 — Exploded view of clutch assembly.

1. Clutch thrust washer
2. Bushing
3. Clutch drum
4. Pressure plate
5. Studs (6 used)
6. Hub
7. Friction discs (4 used)
8. Steel plates (3 used)
9. Shock dampers (6 used)
10. Washers (6 used)
12. Spring plate
13. Screws (6 used)
14. Release pusher
15. Outer plate



1. Plate
2. Pins (5 used)
3. Gear change drum (cam)
4. Guide pins (2 used)
5. Shift fork (1st & 2nd)
6. Shift fork (3rd & 4th)
7. Neutral switch contact
8. Neutral indicator switch
9. Input shaft and low pinion
10. Third speed pinion
11. Washer
12. Snap ring
13. Second speed pinion (sliding)
14. Fourth speed pinion
15. First speed gear
16. Third speed gear (sliding)
17. Snap ring
18. Washer
19. Second speed gear
20. Output shaft and fourth gear
21. Spacer
22. Output sprocket

Fig. K1-15—Exploded view of transmission assembly.

shaft gear and valve cover plate. Care should be taken to prevent valve from absorbing water or becoming too dry. After washing valve in solvent, be sure to wipe with oil to prevent complete drying out. Thickness of new rotary valve is 3.0-3.35MM (0.118-0.132 in.) and valve should be renewed if less than 2.8MM (0.112 in.) thick. Rotary valve cover should be renewed if scratched or depth of valve bore is more than 3.7MM (0.146 inch).

Refer to Figs. K1-15, K1-16 and K1-17. Output shaft low gear (15—Fig. K1-15) should be installed with grooved side facing toward third gear (16). Mating surfaces of crankcase halves should be coated with non-hardening type sealer.

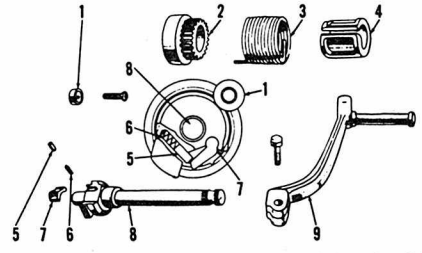


Fig. K1-16—Kick starter assembly should be installed as shown in the cross sectional drawing.

1. Stop
2. Starter gear
3. Return spring
4. Spring guide
5. Pin
6. Spring
7. Pawl
8. Starter shaft
9. Kick starter pedal

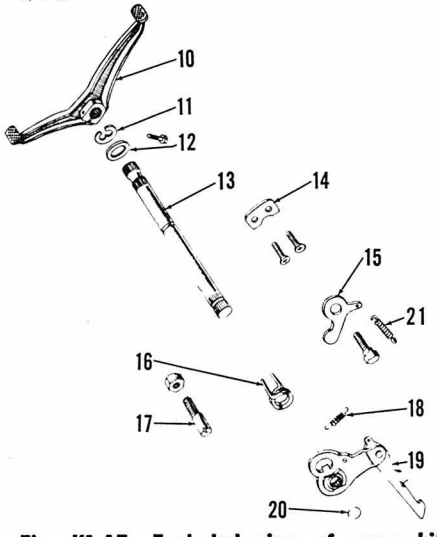


Fig. K1-17—Exploded view of gear shift linkage. Lever (19) turns selector drum (3—Fig. K1-15) by catching pins (2).

10. Gear change pedal
11. Snap ring
12. Washer
13. Pedal shaft
14. Positioning plate
15. Drum stop lever
16. Pedal return spring
17. Spring pin
18. Change lever spring
19. Change lever
20. Snap ring
21. Drum lever spring

Late C2TR models were equipped with a two speed transmission mounted on the output shaft of main transmission. Trail gear box may be removed after placing the selector lever in "L" position and removing four screws that secure cover. Pull on cover and strike lightly with a soft faced hammer. Oil will drain from case as cover is removed. Take care not to lose the eight steel balls that will fall from case as cover is removed. Refer to Fig. K1-19 for arrangement of gears. Steel balls (3) may be held in position with grease on reassembly. Unit should be filled to level of filler plug with same oil as main transmission.

SPEED TUNING

Kawasaki has provided the following suggestions for improving the performance of the models indicated. Any modification will void manufacturer's warranty.

J1 Models

A cylinder, head, piston and other related parts from a D-1 may be installed on a J-1 model to increase displacement to 100 cc. Carburetor must be rejetted to match D-1 specifications. Make certain that ignition is

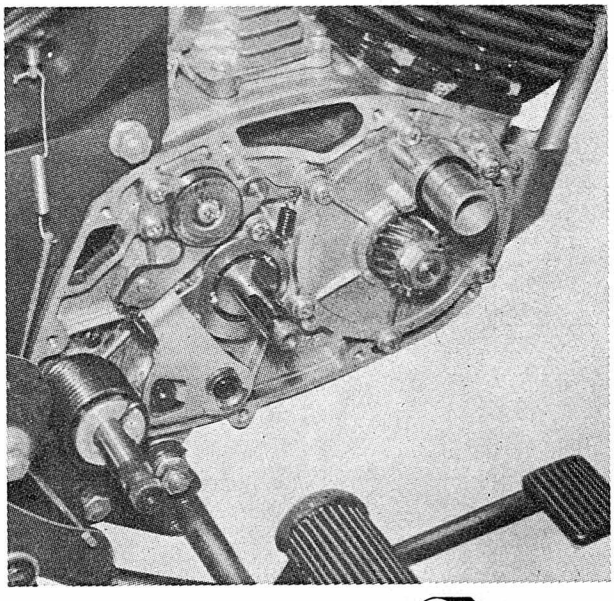


Fig. K1-18—View of gear shift linkage installed.

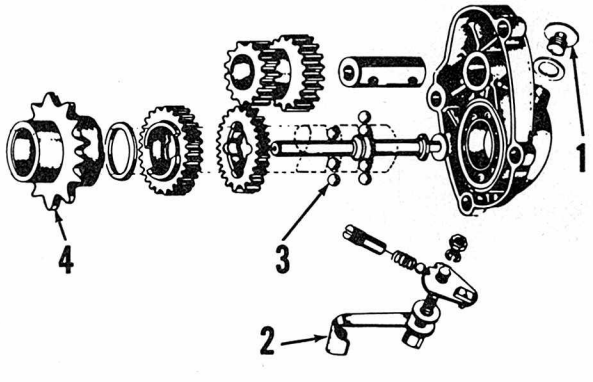


Fig. K1-19 — Exploded view of two speed gear box used on late C2TR models.

1. Filler plug
2. Selector lever
3. Steel balls
4. Drive sprocket

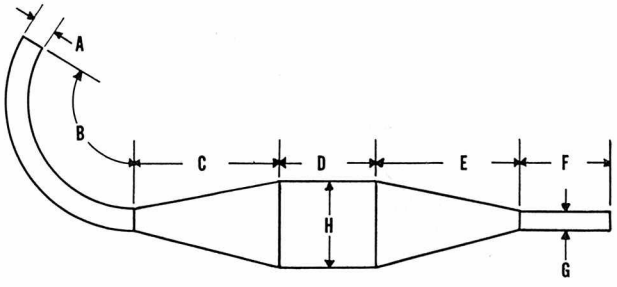


Fig. KT1-1—Refer to text for dimensions of expansion chamber best suited to performance desired.

set at 19 degrees BTDC as some J-1 models were timed to fire 25 degrees BTDC.

An expansion chamber may be constructed from the following specifications: (See Fig. KT1-1) All dimensions are in inches.

Scrambler	Road Race
A. 1.259	1.259
B. 9.85	3.93
C. 11.8	14.96
D. 6.29	3.93
E. 9.44	10.62
F. 7.87	5.70
G. 0.75	0.90
H. 3.25	3.25

C2 Models

An engine with the following modifications should have a cooler spark plug (an NGK type B-8HN is recommended) and #160-#170 main jet installed.

Remove the rotary valve cover and polish the fuel air passage. Cut the rotary valve to open 10 degrees sooner and close 5 degrees later than standard. (See Fig. KT1-2)

Cylinder head should be milled 2.5 MM (0.1 in.). Be sure to reshape taper at edge of combustion chamber.

Top of exhaust port should be raised until it is 1.23 inches from top of cylinder. Do not square top of exhaust port, it should be rounded to prevent ring snagging.

An expansion chamber may be constructed from the following specifications: (See Fig. KT1-1) All dimensions in inches.

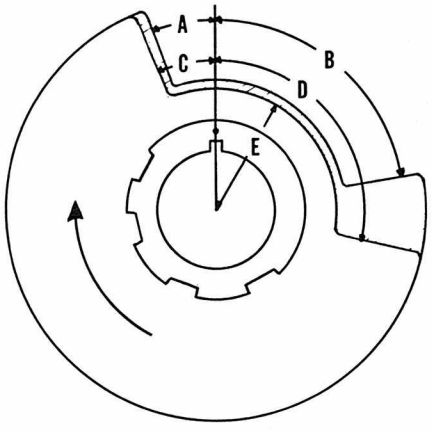


Fig. KT1-2—Rotary valve may be modified to alter performance. Refer to text for exact dimensions.

A. 1.259	E. 10
B. 8-12*	F. 6
C. 15.25	G. 1
D. 4	H. 3.25

*A 12 inch pipe will provide maximum torque and an 8 inch pipe will provide maximum RPM. Kawasaki recommends a 10½-11 inch pipe for TT or Scrambles.

KAWASAKI

F1, F2, F3 AND F4 MODELS

MODEL	F1, F1TR	F2, F2TR	F3	F4
Displacement-cc	169	169	169	238
Bore-MM	62	62	62	70
Stroke-MM	56	56	56	62
Number of cylinders	1	1	1	1
Oil-fuel ratio	1 to 20		Oil Injection	
Plug gap-inch	0.024-0.028	0.024-0.028	0.024-0.028	0.024-0.028
Point gap-inch	0.012-0.016	0.012-0.016	0.012-0.016	0.012-0.016
Ignition timing-Advance	Fixed	Fixed	Fixed	Fixed
Degrees BTDC	20	20	23	23
Electrical system voltage	12	12	12	12
Battery terminal grounded	Negative	Negative	Negative	Negative
Tire size-front	*2.50x18	*2.50x18	3.00x19	3.25x19
Rear	*2.75x18	*2.75x18	3.50x18	4.00x18
Tire pressure (psi)-front	22	22	22	24
Rear	28	28	28	30
Rear chain free play-inch	¾	¾	¾	¾
Number of speeds	4	4	4	4
Weight-lbs. (approx.)	252**	253**	260	264

*On F1TR and F2TR, front tire size is 2.75x18 and rear is 3.00x18

**Weight is 264 on F1TR and 273 on F2TR

MAINTENANCE

SPARK PLUG. Recommended spark plug electrode gap is 0.024-0.028 inch. Recommended spark plug for normal use in F1 and F2 models is NGK type B-7HZ or Champion L-5. Plug for normal use is NGK type B-8HC or Champion L-81 in F3 models. In F4 models, NGK type B-9HC or Champion L-78 is recommended.

CARBURETOR. A Mikuni carburetor is used on all models. A flange mounted carburetor is attached to rear of cylinder on piston ported F1 models. A sleeve mounted carburetor is clamped to the rotary valve cover on right side of other models.

On F1 models, the idle mixture needle (11—Fig. K2-1) should be approximately ¾-turn open and clip (5) should be in the fourth groove

from top of needle (6). Idle speed is adjusted at screw (2).

On F2 and F3 models, initial setting for idle mixture needle (11—Fig. K2-2) is 1¾ turns open. Initial setting is 1¼ turns open on F4 models. Clip (5) should be in second groove from top of needle (6) on F2 models and in third groove from top on F3 and F4 models.

On all models, refer to the following standard specifications:

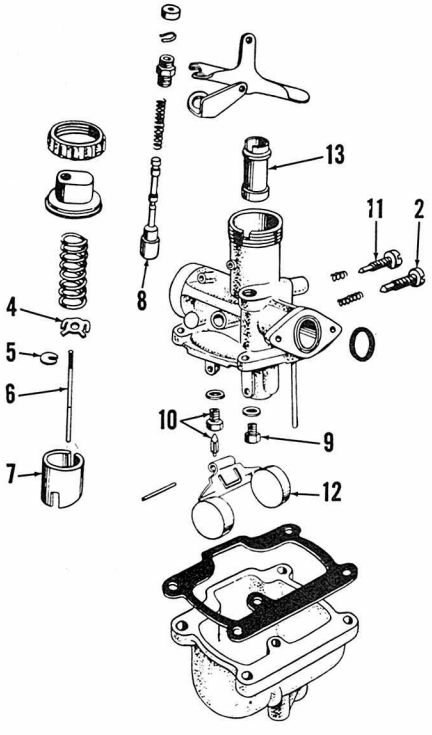


Fig. K2-1 — Exploded view of VM24SH flange mounted carburetor used on F1 models.

2. Idle speed adjuster
4. Retainer
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Fuel inlet valve
11. Idle mixture (pilot air) needle
12. Float
13. Needle jet

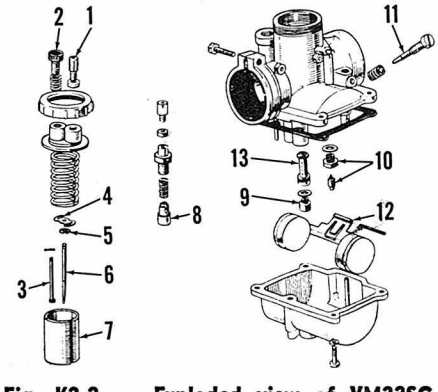


Fig. K2-2 — Exploded view of VM22SC sleeve mounted carburetor used on F2 models. Idle speed rod (3) is attached to idle speed adjuster (2) and stops the throttle slide (7). Carburetors used on F3 and F4 models are similar. Refer to Fig. K2-1 for legend.

F1

Main jet (9)	#130
Needle jet (13)	0-0
Valve needle (6)	4D3
Float level (Fig. K2-3)	0.87-0.94 inch

F2

Main jet (9)	#230
Needle jet (13)	N-8
Valve needle (6)	4J13
Float level	0.87-0.94 inch

F3

Main jet (9)	#190
Needle jet (13)	N-6
Valve needle (6)	4J13
Float level	0.94-1.02 inch

F4

Main Jet (9)	#150
Needle jet (13)	0-2
Valve needle (6)	5DP7
Float level	0.94-1.02 inch

Turning the idle mixture needle (11—Fig. K2-1 or K2-2) out leans the fuel mixture.

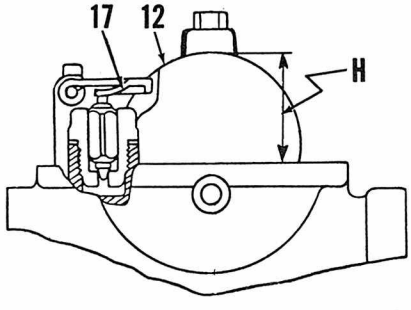


Fig. K2-3—Float level (H) is adjusted by bending tang (17).

IGNITION AND ELECTRICAL (F1, F2 AND F3 MODELS). The combined starter-generator is mounted on the left end of the crankshaft. The brushes should be renewed if less than 0.55 inch (14MM). Brush springs tension should be at least 300 grams (0.69 lbs.). Generator shunt coil resistance should be 6.30 ohms at 68° F. when checked at terminals (F&D—Fig. K2-5). Resistance between terminals (M & D) should be 0.0136 ohms at 68° F. Adjust regulating points of the fixed voltage relay if no load voltage at 2,500 engine RPM is not within limits of 14.7-15.7 volts. Cut-in voltage should be within limits of 12.5-13.5 volts and cut-out voltage should not be less than 8 volts. The starter relay (magnetic switch) opening voltage should be 0.5-5.0 volts and should close with less than 8 volts. The voltage regulator is mounted inside the frame under the seat.

The battery ignition system breaker points and condenser are mounted on the starter-generator housing. The breaker point cam is attached to end of generator armature. The ignition coil is located inside the frame under the fuel tank.

Ignition breaker point gap should be 0.012-0.016 inch (0.3-0.4MM). Ignition should just occur (points just open) at 20 degrees BTDC on F1 and F2 models and 23 degrees BTDC on F3 models. Piston will be 0.082 inch (2.087 MM) BTDC on F1 and F2

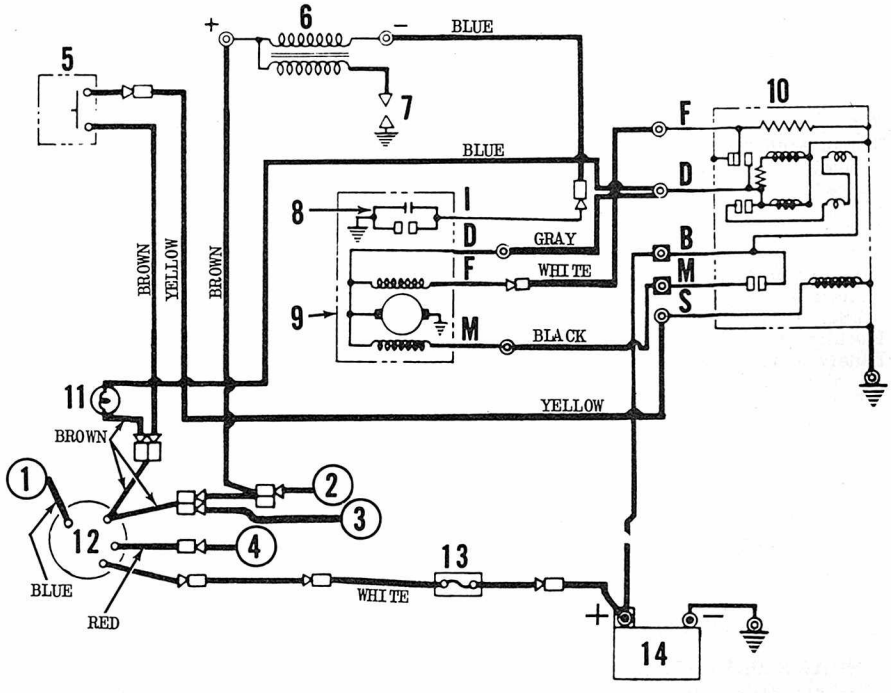


Fig. K2-5—Diagram of ignition, generator and starter systems typical of F1, F2 and F3 models.

1. Wire to lights
2. Wire to brake light
3. Wire to horn
4. Wire to tail light
5. Starter switch
6. Ignition coil
7. Spark plug
8. Breaker points and condenser
9. Generator-starter
10. Regulator and starter relay
11. Charge indicator light
12. Main (key) switch
13. Fuse
14. Battery

models and 0.108 inch (2.75 MM) BTDC on F3 models. Yellow mark (Y—Fig. K2-6) on ignition cam should align with pointer (P) at this time. Ignition timing may be adjusted by loosening screw (S) and turning base plate. Ignition timing can be checked with engine running using a power timing light.

IGNITION AND ELECTRICAL (F4 MODELS). A flywheel magneto is mounted at the left end of crankshaft on F4 models. A 12V battery is mounted beneath the seat to provide static power to neutral indicator light, horn, brake light and turn signal indicators if mounted. Other lighting functions are AC operated. A rectifier (1—Fig. K2-7) is mounted on the frame to provide DC current for battery charging and DC equipment when engine is running.

Maximum point gap should be set at 0.012-0.016 inch. Ignition should occur (points just open) at 23 degrees BTDC. Piston will be 0.121 inch (3.09 MM) BTDC and timing marks on rotor (4) and front cover (7) will align at this point.

LUBRICATION. Models F1 and F1TR are lubricated by mixing two stroke engine oil with the fuel. Ratio should be 1:15 for the first 600 miles; and 1:20 after new or overhauled motor is broken in.

Other models are equipped with an automatic oil injection system. On models with oil injection, refer to the following section.

The gear box and clutch is lubricated by 0.95 quart of SAE 30 motor oil. Gear box oil should be maintained between the two marks on filler plug dipstick when the filler plug is screwed in. Oil should be changed after the first 300 miles and every 1800 miles thereafter.

OIL INJECTION. The oil injection system automatically meters and pumps oil from a separate tank to the rotary valve cover plate. The oil tank should be filled with two stroke motor oil and should **never** be allowed to run dry.

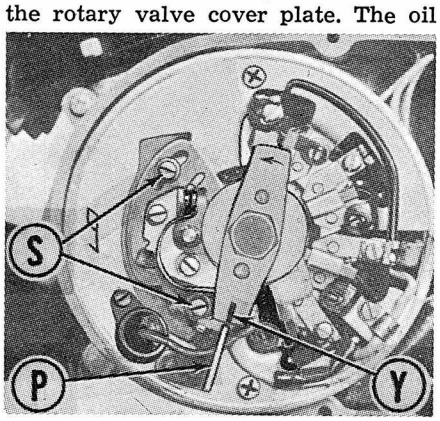


Fig. K2-6—On F1, F2 and F3 models, the breaker points should just open when yellow mark (Y) is exactly in line with pointer (P). Refer to text.

Fig. K2-7 — Major electrical components used on F4 Models.

1. Rectifier
2. High tension coil
3. Resistor
4. Rotor
5. Rear cover
6. Stator
7. Front cover
8. Base plate
9. Condenser
10. Point cam
11. Ignition points

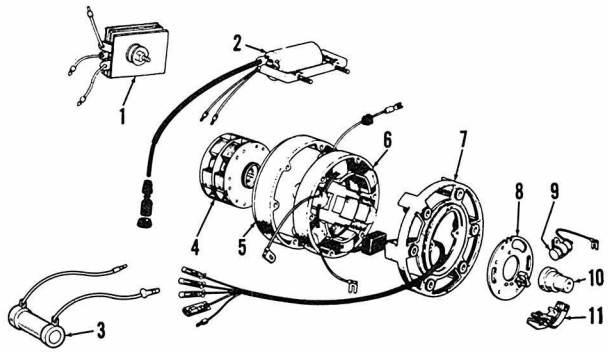
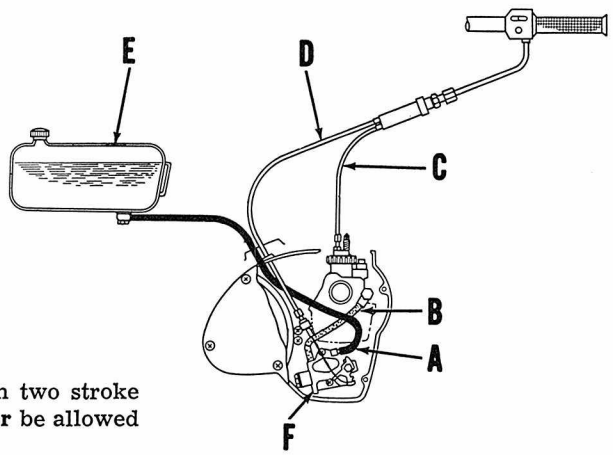


Fig. K2-8 — Drawing of "SUPERLUBE" oil injection system. Check valve is in the banjo fitting at rotary valve cover plate end of outlet line (B).

A. Oil inlet line
B. Oil outlet line
C. Carburetor cable
D. Oil pump cable
E. Oil tank
F. Oil pump



If the system is drained or the pump unit is renewed, air should be bled from the system before engine is started. Allow oil to flow from inlet line (A—Fig. K2-8) before attaching to pump inlet connection. Disconnect outlet oil line (B) at the check valve on rotary valve cover then operate kick starter with key turned off and throttle open until the outlet line is full of oil. Reconnect oil line to the rotary valve cover.

To adjust the pump control cable, set the engine idle speed to 1100-1300 RPM by turning idle speed adjuster (2—Fig. K2-9). Take up play in throttle cable by turning guide (1). Be careful not to raise the throttle slide when adjusting the cable guide. Turn oil pump control cable guide (3) until clearance (C) between control lever and stop is less than 0.02 inch. Make certain that the pump control lever begins to move immediately

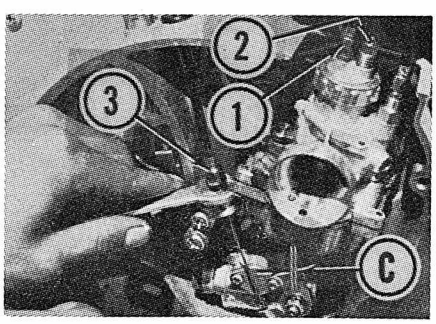


Fig. K2-9—Refer to text for adjustment of the oil injection system. The engine may be damaged if adjustment is incorrect.

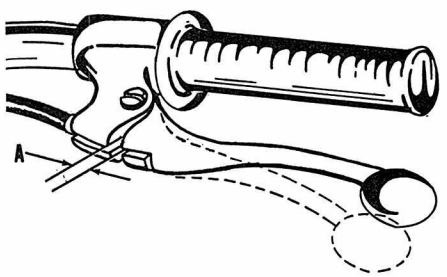


Fig. K2-10—Clutch hand lever should have 0.08-0.12 in. free play at A.

when throttle slide begins to move. If oil pump control cable is too loose, clearance (C) may be zero even when throttle slide is partially open resulting in not enough lubrication. Adjust the cable from hand lever to joint under the tank until hand grip has 0.008-0.024 inch free play.

To remove the oil pump, it is necessary to remove the carburetor cover, carburetor, engine right side cover and pump drive gear before unbolting pump from the right side cover. Individual parts are not available for the pump unit. If damaged, the complete assembly must be renewed.

When reinstalling, make certain that pump is adjusted and primed with oil as previously outlined before starting engine.

CLUTCH CONTROLS. The clutch is located on the right end of the transmission input shaft. The hand lever should have 2-3MM (0.08-0.12 in.) free play as measured at (A—

Fig. K2-10). Adjustment is accomplished by loosening lock nut (1—Fig. K2-11) and turning the adjusting screw (2) in until resistance is felt. Then back the adjusting screw (2) out ¼-turn and tighten lock nut. Adjust the cable guide (3) until hand lever has approximately $\frac{3}{32}$-inch play at (A—Fig. K2-10).

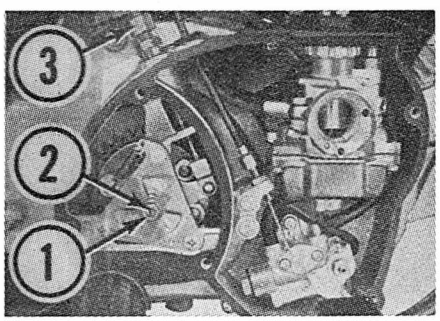


Fig. K2-11—Clutch should be adjusted at screw (1) as described in text. Cable guide (3) adjusts the handle free play.

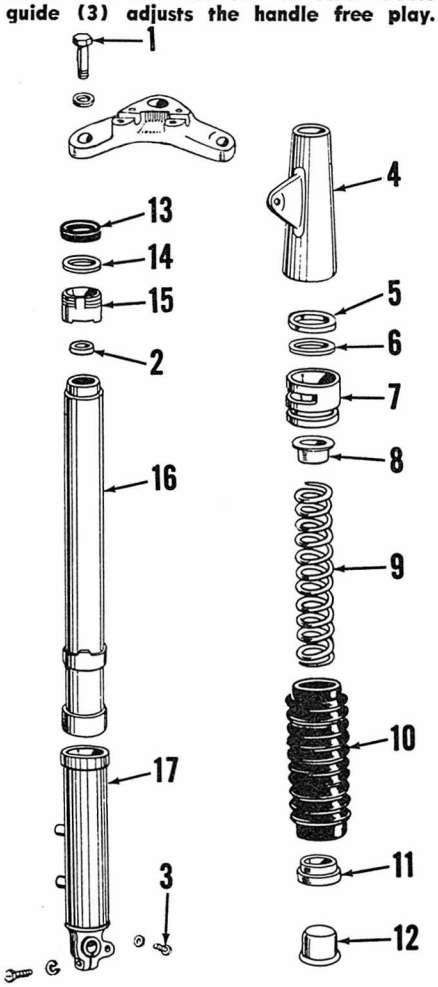


Fig. K2-12—Exploded view of front suspension unit typical of type used on F1, F2 and early F3 models.

1. Filler screw
2. Top seal
3. Drain plug
4. Cover
5. Washer
6. Gasket
7. Cover guide
8. Spring seat
9. Spring
10. Boot
11. Spring seat
12. Dust shield
13. Oil seal
14. Washer
15. Tube nut
16. Inner tube
17. Outer (sliding) tube

SUSPENSION. Front suspension units on F4 models contain 195cc of oil each. Units on all other models contain 175 cc of oil each. Oil used should be a mixture of 80% SAE 30 and 20% SAE 60.

Rear suspension units are not repairable and should be renewed if bent, leaking or damaged.

REPAIRS

PISTON, RINGS AND CYLINDER. The piston can be removed after removing the exhaust pipe, cylinder head and cylinder. Refer to the following specifications.

Ring end gap 0.15-0.3MM
0.006-0.012 in.
wear limit 0.7MM (0.028 in.)
Piston pin diameter..15.994-16.00MM
0.6295 inch
wear limit 15.95MM (0.628 in.)
Standard cylinder bore diameter—
175 cc Models.....62.0-62.02MM
2.4409-2.4417 in.
250 cc Models 70.0-70.02MM
2.7559-2.7565 in.
Piston skirt to cylinder clearance—
(F1 and F2 models) .....0.002 in.
(F3 models) .....0.003-0.0038 in.
(F4 models) .....0.0024-0.0040 in.

Piston skirt to cylinder clearance should be measured at right angles to piston pin. Chrome plated piston ring should be installed in top groove. Expander ring is installed behind lower ring. Piston must be installed with arrow on top toward exhaust port (front). Piston should be heated to approximately 250 degrees F. before piston pin is installed. Cylinder and head retaining nuts should be tightened to 16 Ft.-Lbs. torque.

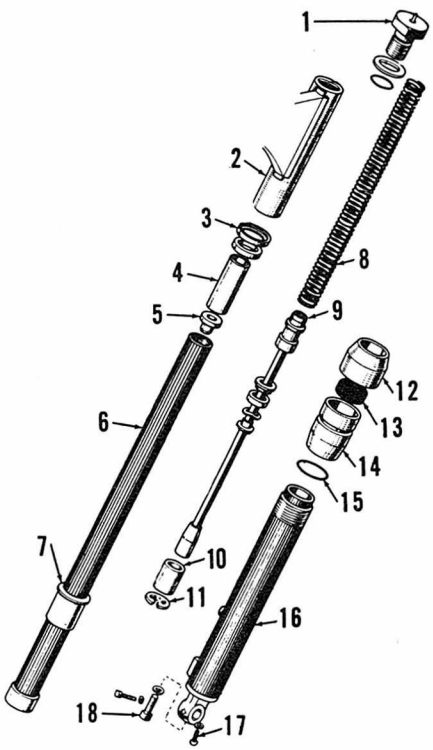


Fig. K2-13—Exploded view of F4 front suspension unit. Later F3 versions are similar.

1. Fork top bolt
2. Head light holder
3. Washer
4. Spring guide spacer
5. Spring guide
6. Inner fork tube
7. Metal slider
8. Fork spring
9. Fork cylinder
10. Fork piston
11. Piston clip
12. Dust shield
13. Oil seal
14. Outer tube nut
15. "O" ring
16. Outer tube
17. Oil drain screw
18. Fork cylinder holding bolt

CONNECTING ROD AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Maximum runout of crankshaft must not exceed 0.004 inch. Standard limit is 0.0012 inch. Connecting rod side clearance between crankshaft counterweights should be 0.0098-0.012 inch. Vertical movement of connecting rod should be less than 0.2MM (0.008 in.). Renew piston pin and/or bearing if radial clearance exceeds 0.004 inch.

CLUTCH. The multiple disc, wet type clutch is mounted on the right end of the transmission input shaft. Clutch springs (11—Fig. K2-14) should have 24.5MM (0.964 in.) free length and should be renewed if less than 23MM (0.906 in.). Friction discs (7) should be 4.0MM (0.157 in.) thick

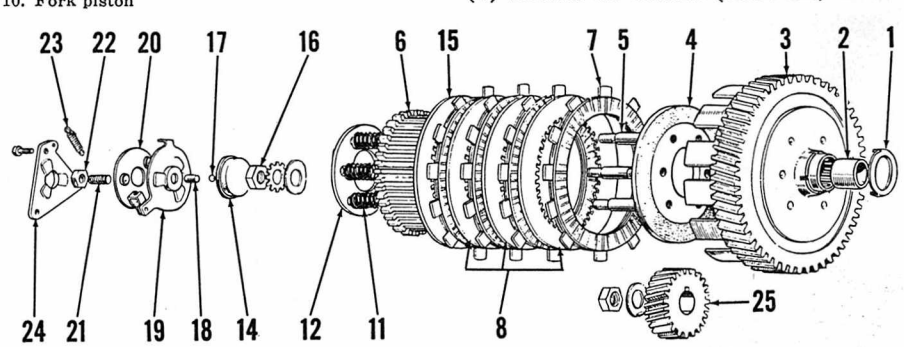


Fig. K2-14—Exploded view of clutch assembly.

1. Thrust washer
2. Bushing
3. Clutch drum
4. Pressure plate
5. Studs (6 used)
6. Clutch hub
7. Friction discs (4 used)
8. Steel plates (3 used)
11. Clutch springs
12. Spring plate
14. Release pusher
15. Outer plate
17. Ball
18. Roller
19. Release plate
20. Release balls
21. Adjusting screw
22. Lock nut
23. Release spring
24. Cam plate
25. Crankshaft gear

and should be renewed if less than 3.65MM (0.143 in.). Gap between drum and lugs on friction discs should be 0.4-0.47MM (0.0016-0.018 in.). Renew the clutch drum (3) and/or discs (7) if clearance is excessive or drum is grooved.

CRANKCASE AND GEARBOX. The crankshaft and transmission parts can be removed after the crankcase halves are separated as shown in Fig. K2-16. Refer to Figs. K2-17, K2-18 and K2-19 for exploded views. When assembling, make certain that grooved side of first gear (15) on output shaft is toward second gear (16). If incorrectly installed, first gear will remain engaged. Mating surfaces of crankcase halves should be coated with a non-hardening sealer. Gasket is not used between crankcase halves. Sealing surfaces must be perfectly smooth and sealer must be applied evenly to all mating surfaces to prevent leakage. Screws attaching crankcase halves together should be tightened evenly.

On F2, F3 and F4 models, the rotary valve is located on the right side of crankshaft. It is necessary to remove the carburetor, clutch cover, clutch and crankshaft gear before removing the valve cover plate. Care should be taken to prevent valve from absorbing water or becoming too dry. After washing in solvent, be sure to wipe with oil to prevent complete drying out. The rotary valve should be renewed if thickness is less than 0.112 inch (2.8MM). Renew the valve cover plate if worn or grooved.

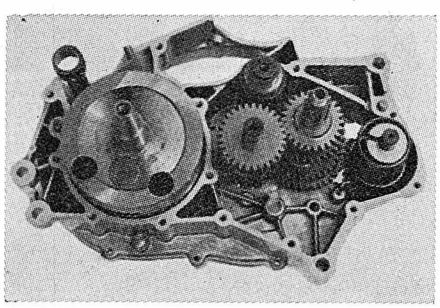


Fig. K2-16—View of right half of crankcase with crankshaft and transmission correctly positioned for reassembly.

1. Plate
2. Change pins (5 used)
3. Shift drum
4. Guide pins (2 used)
5. Shift fork (1st & 3rd)
6. Shift fork (2nd & 4th)
7. Switch contact
8. Switch
9. Input shaft and low pinion
10. Second speed pinion
11. Spacer
12. Snap ring
13. Third (sliding) pinion
14. Fourth speed pinion
15. First gear
16. Second gear
17. Thrust washer
18. Third gear
19. Output shaft and 4th gear
20. Spacer
21. Output sprocket

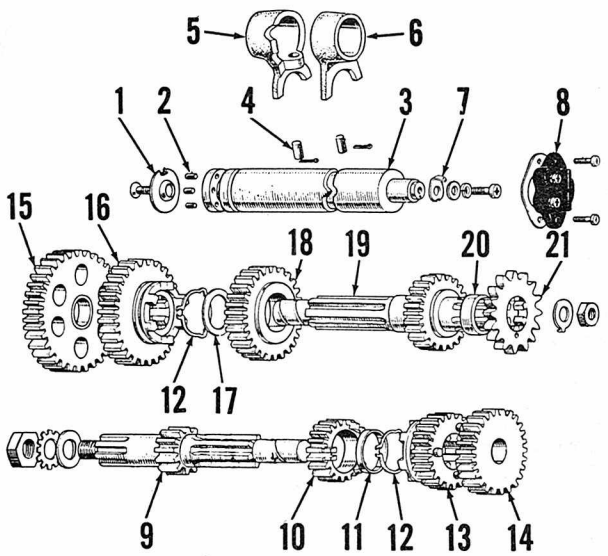


Fig. K2-17—Exploded view of transmission assembly. Top and neutral indicator switch (8) grounds the green light in speedometer housing when in neutral and yellow light when in fourth gear.

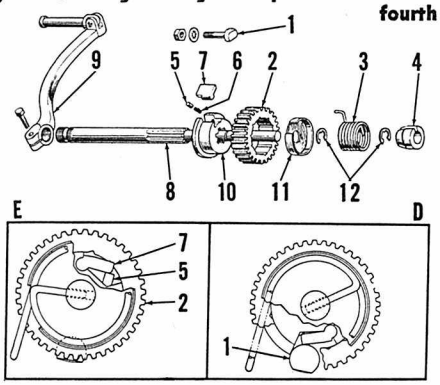


Fig. K2-18—Exploded view of kick-starter assembly. View "E" shows pawl (7) engaged when starting. When disengaged as shown in view "D", the pawl is retracted by contacting stop (1).

1. Stop
2. Starter gear
3. Return spring
4. Spring guide
5. Plunger
6. Spring
7. Pawl
8. Starter shaft
9. Kick starter pedal
10. Drum
11. Gear holder
12. Snap rings

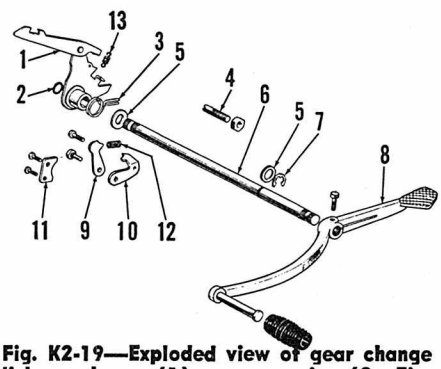


Fig. K2-19—Exploded view of gear change linkage. Lever (1) engages pins (2—Fig. K2-17) and turns the shift drum.

1. Gear change lever
2. Snap ring
3. Return spring
4. Spring pin
5. Washers
6. Shaft
7. Snap ring
8. Gear change pedal
9. Drum detent
10. Plate
11. Drum retainer plate
12. Detent spring
13. Gear change ratchet spring

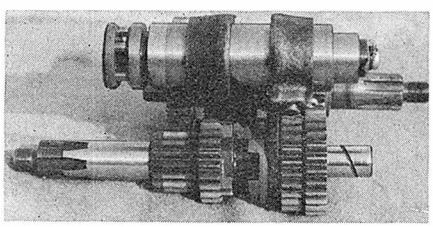


Fig. K2-20—View of F3 transmission and shifter assembly ready for installation in case.

KAWASAKI A1 AND A7

MODEL	A1 Samurai	A1SS Street Scrambler	A7 Avenger	A7SS Street Scrambler
Displacement-cc	247	247	338	338
Bore-MM	53	53	62	62
Stroke-MM	56	56	56	56
Number of cylinders	2	2	2	2
Oil-fuel ratio	Oil pump			
Plug gap-inch	0.016-0.020	0.016-0.020	0.016-0.020	0.016-0.020
Point gap-inch	0.012-0.016	0.012-0.016	0.012-0.016	0.012-0.016
Ignition timing	Fixed	Fixed	Fixed	Fixed
Degrees BTDC*	23	23	23	23
Electrical system voltage	12	12	12	12
Battery terminal grounded	Negative	Negative	Negative	Negative
Tire size-front	3.00x18	3.00x18	3.25x18	3.25x18
Rear	3.25x18	3.50x18	3.50x18	3.50x18
Tire pressure-front	24	24	24	24
Rear	32	32	32	32
Rear chain free play	¾-1 inch	¾-1 inch	¾-1 inch	¾-1 inch
Number of speeds	5	5	5	5
Weight-lbs. (approx.)	319	319	327	329

*CDI ignition models are timed to fire at 25 degrees BTDC.

MAINTENANCE

SPARK PLUGS. Recommended spark plugs for normal use are NGK type B-9HC on models without capacitor discharge ignition. Champion type L-5 or L-58R can be used. Electrode gap should be 0.016-0.020 inch. CDI equipped units should use NGK type BUHX surface gap spark plugs or Champion type UL19V. Spark plugs should be tightented to 135-170 inch-pounds torque.

CARBURETORS. A1 models use two Mikuni VM22SC carburetors. Mikuni VM26SC carburetors are used on A7 models. On all models, the carburetors are mounted under the outside covers on each side of engine. Inlet timing to the crankcase is controlled by rotary valves at each end of the crankshaft. It is important that both carburetors be checked and adjusted at the same time.

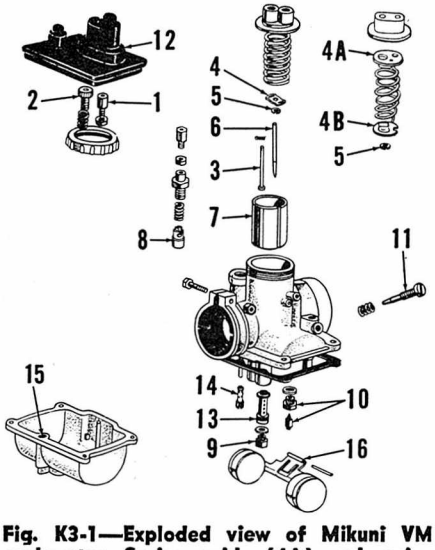


Fig. K3-1—Exploded view of Mikuni VM carburetor. Spring guide (4A) and spring seat (4B) are used on A7 models.

1. Throttle cable guide
2. Idle speed adjuster
3. Idle stop rod
4. Clip retainer (250cc)
4A. Spring guide (350cc)
4B. Spring seat (350cc)
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Fuel inlet needle and seat
11. Idle mixture needle
12. Sealing cover
13. Needle jet
14. Pilot jet
15. Starting jet
16. Float

Idle speed should be approximately 1400 RPM and is set by turning the adjusters (2—Fig. K3-1). Make certain that both adjusters are set the same. If correctly set, the throttle slides (7) for both carburetors will be open exactly the same amount at idle speed and the exhaust pressure will be the same for both cylinders. If incorrectly set, one throttle slide will be up (open) more than the other and engine will not idle smoothly at 1400 RPM.

When opening the throttle from the idle position, both throttle slides should begin to move and should both reach the top at exactly the same time. If the opening of the two carburetors is not synchronized, adjust the cable guides (1). The oil pump control is also connected to the throttle and must be checked if it is necessary to adjust the throttle cable guides. Refer to the appropriate paragraphs in the LUBRICATION section for adjusting the oil pump control cable.

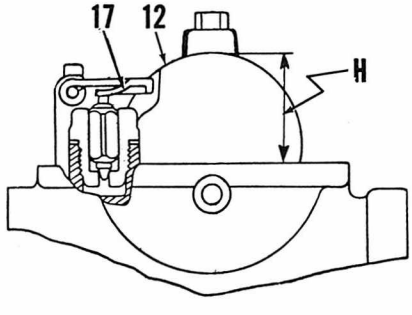


Fig. K3-2—Float height (H), should be adjusted by bending tang (17).

Idle mixture is adjusted by the pilot air screws (11). Initial (normal) setting is 1¼ turns open on 250cc models; 1 turn open for 350cc models. It is necessary to remove the carburetor side covers to adjust the idle mixture. Turning the needles out leans the idle mixture. Make certain that air cleaner is not clogged and **all** of the rubber intake passage seals are in good condition.

Fuel level should be adjusted by removing float bowl, inverting carburetor and measuring distance (H—Fig. K3-2) between gasket surface of carburetor body and top of float. Float height (H) should be 22-23MM (0.86-0.95 inch) on 250cc models and 24-26MM (0.95-1.02 inch) on 350cc models.

Refer to Fig. K3-1 and the following recommended carburetor specifications.

VM22SC (A1 models)

Main jet (9) .....#150
Jet needle (6) 4J13-3
Needle jet (13) 0-6
Pilot jet (14) .....#30
Starter jet (15) .....#60
Clip (5) should be in third groove from top of needle (6).

VM26SC (A7 models)

Main jet (9) .....#190
Jet needle (6) 4L6-3
Needle jet (13) 0-4
Pilot jet (14) .....#40
Starter jet (15) .....#60
Clip (5) should be in third groove from top of needle (6).

IGNITION AND ELECTRICAL. Several different configurations of electrical systems are installed on A1 and A7 models. Timing marks and characteristics of the various systems are not identical; therefore, it must be noted which system is in use on the model in question. Refer to the following chart and paragraphs for engine serial number and alternator model applications.

The various alternators used must be driven at intended speed in the intended direction or engine performance will be severely affected. Alternator model numbers should be used to determine proper installation and timing procedure.

Engine Serial No.	Model	ALTERNATOR		
		Model	Speed*	Direction Rotation**
A1E00001-A1E02533	A1	EN04	½	CCW
A1E02534-A1E09300	A1	EN09 or EN11	1	CW
A1E60001-A1E64623	A1SS	EN09 or EN11	1	CW
A7E00001-A7E04000	A7	EN11	1	CW
A1E10001-A1E20000	A1	EN10 or EN08	½	CCW
A1E70001-A1E80000	A1SS	EN10 or EN08	½	CCW
A7E10001-A7E13181	A7	EN08	½	CCW
A7E60001-A7E70000	A7SS	EN08	½	CCW
AFTER A1E20000	A1	CDI	½	CCW
AFTER A1E80000	A1SS	CDI	½	CCW
AFTER A7E13181	A7	CDI	½	CCW
AFTER A7E70000	A7SS	CDI	½	CCW

* In relation to crankshaft speed.
** Viewed from left side of motorcycle.

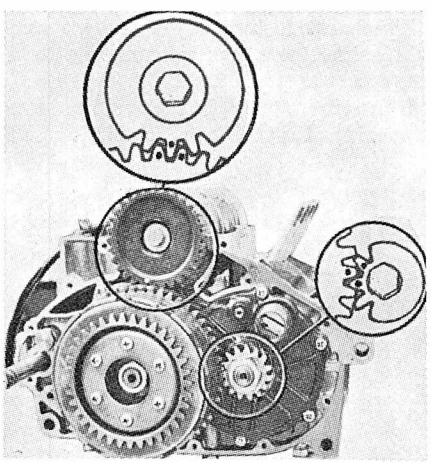


Fig. K3-3—View of timing marks aligned for models that turn alternator at ½ crankshaft speed.

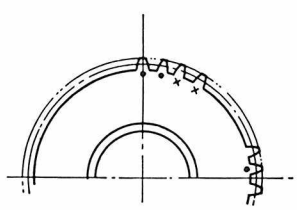


Fig. K3-4—View of timing marks used on some clutch gears. Refer to text.

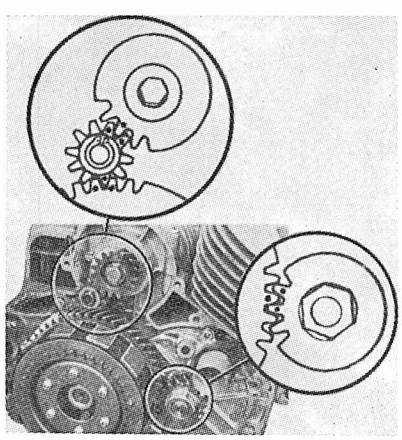


Fig. K3-5—View of timing marks aligned for models that turn alternator at same speed as crankshaft.

EN04, EN08, EN10 and CDI Alternator Installation. Alternator is driven by the primary gear on clutch via a Bakelite gear with 30 teeth. Timing marks must be aligned as shown in Fig. K3-3. NOTE: There should be a total of eleven unmarked teeth between marks on clutch primary gear. Some clutch gears are punch marked and "X" marked (Fig. K3-4). These gears are marked to allow installation with either type drive. If both type of marks are present use "X" marks to time engine.

EN09 and EN11 Alternator Installation. Alternator is driven by an idler gear with 15 teeth mounted next to clutch primary gear. Timing marks must be aligned as shown (Fig. K3-5) with 13 teeth on clutch gear between timing marks used. If clutch gear with punch and "X" marks is used (Fig. K3-4), align single mark on idler gear between two punch marks on clutch primary gear.

Ignition Adjustment on Models With Contact Breaker Points. Adjust ignition points to maximum gap of 0.012-0.016 inch. Ignition should occur (points just open) when piston is 0.110 inch (2.79 mm) Before TDC. Check and adjust timing for left cylinder first, using a dial indicator in spark plug hole to correctly locate the crankshaft. On all models, timing for left cylinder is adjusted by moving the breaker point base plate. Check timing for the right cylinder in a similar manner **only** after timing is correct for left cylinder. To adjust timing for the right cylinder on early models, vary the breaker point gap within the limits of 0.012-0.016 inch. On some later models, the breaker points for right cylinder are mounted on a separate base plate which can be moved to set timing without changing breaker point gap.

The timing pointer (P—Fig. K3-6) should align exactly with marks (R & M) when pistons are correctly located at 0.110 inch (2.79 mm) Before TDC. Timing pointer (P) should not be used to check ignition timing, unless it is known to be correctly located. The pointer does not allow for wear of ignition drive gears

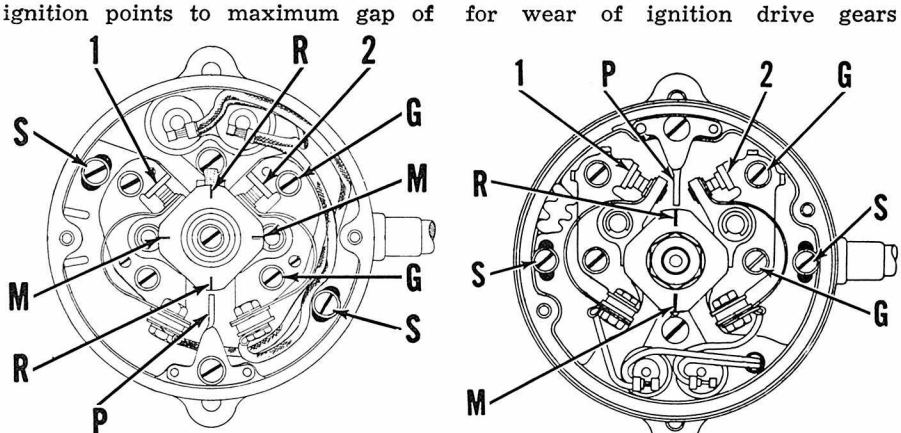


Fig. K3-6—View of breaker point adjustments and timing marks. Unit on left rotates at ½ crankshaft speed in counter-clockwise direction. Unit on right rotates at same speed as crankshaft in clockwise direction.

1. Breaker points left cylinder
2. Breaker points right cylinder

G. Screws for adjusting right cylinder timing (gap)

M. Unpainted mark
P. Pointer
R. Red timing mark

S. Screws for adjusting left cylinder timing

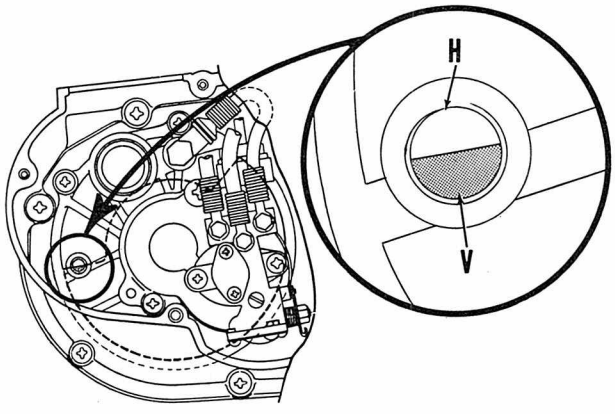


Fig. K3-7 — When the edge of an original (unmodified) rotary valve (V) is covering the lower half of timing hole (H), the left piston is 23 degrees BTDC.

(crankshaft to alternator) and pointer can be easily bent.

Ignition Adjustment on Models With CDI (Capacitor Discharge Ignition). Ignition may be checked by installing a dial in the left cylinder and moving piston to 0.129 inch (3.29 MM) BTDC. One notch on signal generator rotor (1—Fig. K3-8) should be aligned with raised mark (2) on signal pick up (3) at this time. If alignment is not correct, loosen screws that secure base plate and align marks (1 & 2). Timing of right cylinder should be adjusted separately by inserting dial gage in right cylinder and moving small plate that secures pick up for right cylinder.

Ignition timing may be checked with a power timing light at 4000 RPM. Air gap between signal rotor pointer and signal pick up should be 0.012-0.016 inch and may be adjusted by loosening screws (4) that secure pick up.

Explanation of CDI System. Battery current (12 volts DC) is converted to 400 volts DC within the DC to DC converter (Fig. K3-10A). A steady buzz will emit from the "B" unit (4—Fig. K3-10) during the DC to DC conversion. The buzz is produced by a transistor vibrator and anything but a steady buzz is abnormal. A loud snapping sound indicates an internal short and a low hum, weak buzz or no sound at all will indicate low battery voltage or an open circuit. The 400 volts is held in the condenser until a trigger signal charge strikes the thyristor (SCR) and releases the 400 volts to the high tension coil for ignition. Ignition timing therefore is the timing of the trigger signal. A signal generator rotor is mounted on the left end of alternator shaft and as it passes the signal pick up it sets up a small current that is amplified to a sharp trigger signal for precise ignition timing.

Trouble Shooting CDI System. This ignition system is extremely durable in normal operation but can be easily damaged by improper testing or servicing procedures. DO NOT reverse battery terminals, even momentarily. DO NOT disconnect any wires while engine is running, especially battery terminals. If connector plugs used to attach components become corroded, the effect can be the same as disconnecting the wire. Before servicing unit make certain that battery is fully charged, fuse is not blown and that connector plugs are making good contact.

If engine starts but does not run properly, first check condition of

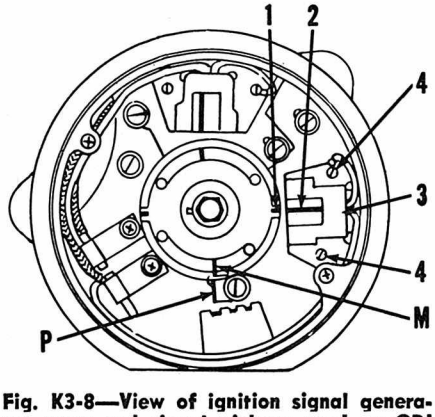


Fig. K3-8—View of ignition signal generator rotor and signal pickups used on CDI models.

1. Cover
2. Breaker points and base plate
3. Condensers
4. Cam oil felt
5. Timing pointer
6. Nut
7. Breaker cam
8. Woodruff keys
9. Rotor
10. Drive gear
11. Screw
12. Rear housing
13. Bearing
14. Stator
15. Front cover
16. Wave washer
17. Screws
18. Front bearing
19. Snap ring
20. Seal
21. "O" ring
22. Seal collar

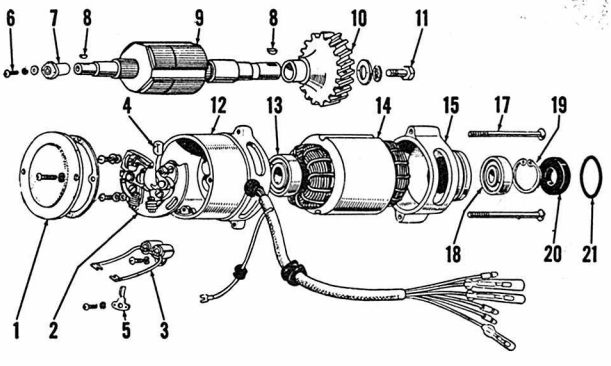


Fig. K3-9—Exploded view of EN09 type alternator. Others are similar in construction.

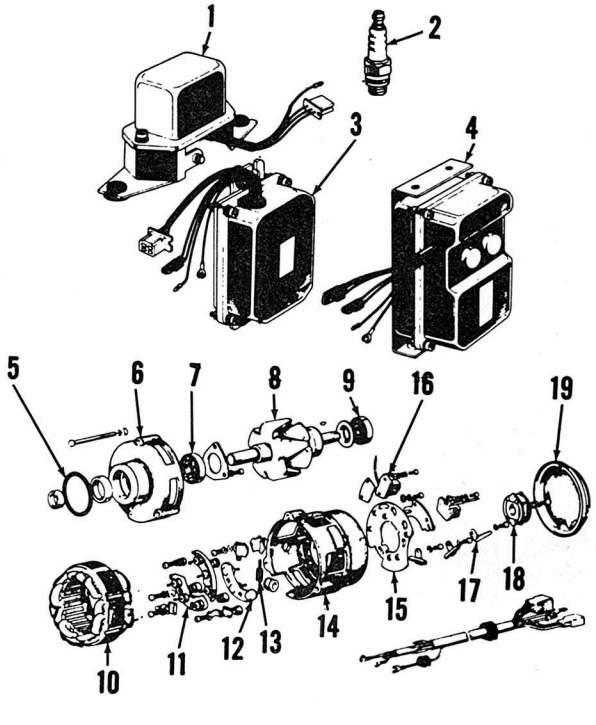


Fig. K3-10—Components of CDI system and exploded view of alternator used on CDI models.

1. Voltage regulator
2. Surface gap spark plug
3. "A" unit
4. "B" unit
5. "O" ring
6. Alternator rear housing
7. Bearing
8. Rotor
9. Bearing
10. Stator
11. Rectifier
12. Rectifier
13. Carbon brush
14. Alternator front housing
15. Base plate
16. Signal pick up
17. Timing pointer
18. Signal generator rotor
19. Cover

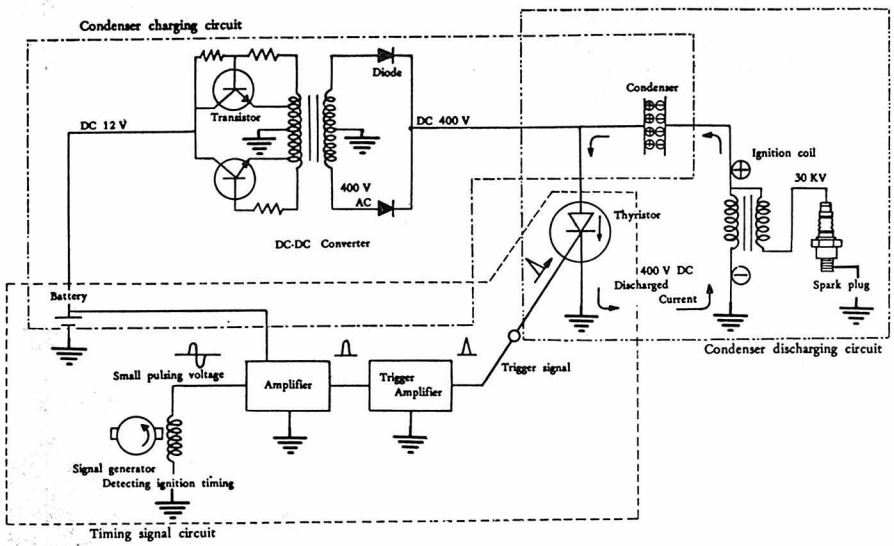


Fig. K3-10A—Simplified diagram of CDI system used on late model A1 and A7 Kawasaki.

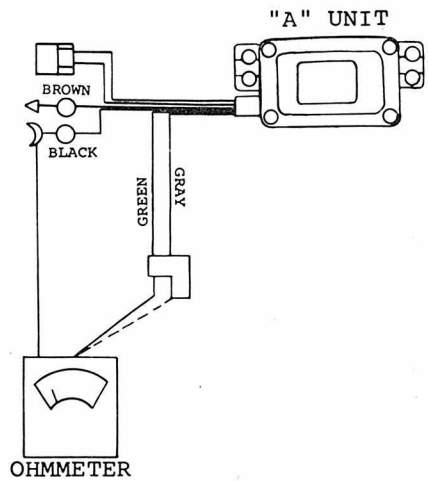


Fig. K3-11A—Connection points for "A" unit test. Disconnect "A" unit from "B" unit to make test.

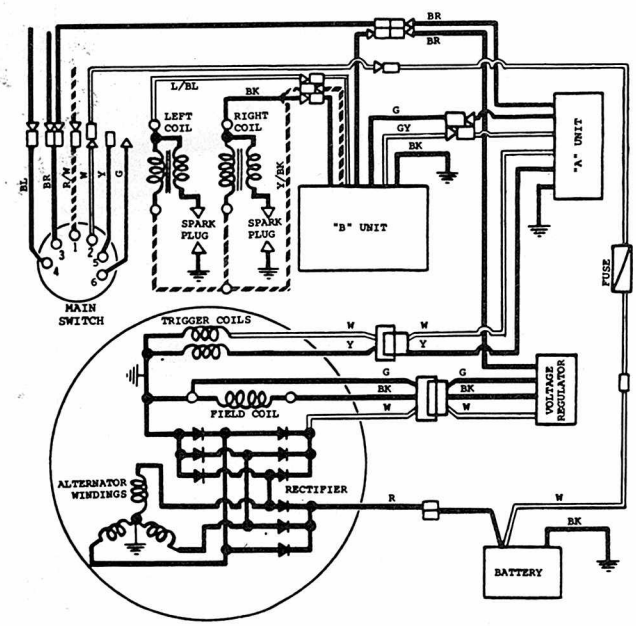


Fig. K3-11—Ignition system schematic for CDI series A1 and A7 model Kawasaki's.

Switch Connections	TAIL LIGHT 1	BAT 2	IGNITION & HORN 3	HEAD LIGHT 4
Stopped				
Day		●		
Night		●	●	●
Parking		●		

spark plugs and high tension wires. If one cylinder seems to be dead, check to see if both cylinders are firing using test plugs or similar equipment. If both cylinders are firing check ignition timing and trigger coil air gap as outlined in previous Ignition Adjustment paragraph. If condition still exists, make certain that problem is caused by faulty ignition, then check individual ignition components as described later. One cylinder not firing can be caused by malfunctioning trigger coil, high tension coil or wiring for the cylinder. Damage to "A" unit (3—Fig. K3-10) or "B" unit (4) can also result in one cylinder not firing. Check individual components as described later.

If engine will not start, use the following procedure. Check battery voltage and make certain that fuse is in good condition. If battery voltage is not within range of 11-13 volts, check condition of charging system. Turn main switch ON and make certain that battery voltage is available to the ignition units. On both "A" unit and "B" unit, the brown wire should be positive and a black wire should be grounded to frame. If 11-13 volts is not available to the ignition units, check wires, connections and main switch for open circuit. The "B" unit (4) is equipped with a transistor vibrator which should produce an audible sound when ignition (main) switch is ON. The sound should be extremely steady (much like a tuning fork). Check for differences in sound with the gray and green wires (from "B" unit to "A" unit) disconnected and connected. If sound is different when gray and green wires are connected, renew the "A" unit. If a snapping sound (internal short) is heard from "B" unit, if "B" unit does not make any sound or if sound is irregular, renew "B" unit. If sound seems to be correct, check to make certain that spark plugs are not firing. It is possible (but unlikely) that coils are connected to incorrect wires causing spark plug to fire at incorrect time (180 crankshaft degrees off). Check resistance of trigger coils and high tension coils with an accurate ohmmeter. Resistance of trigger coils should be 270-350 ohms. Resistance of primary winding in high tension coils should be 3-4 ohms and secondary windings should have 6000-8000 ohms resistance.

The "A" unit (3—Fig. K3-10) can be checked separately as follows using an accurate ohmmeter. Attach ohmmeter lead to green wire and black (ground) wire as shown in Fig. K3-11A, then reverse ohmmeter leads and recheck. Resistance should be infinite with both connections. Check for short between gray wire and black (ground) wire the same way.

The "B" unit (4—Fig. K3-10) can be checked separately as follows using

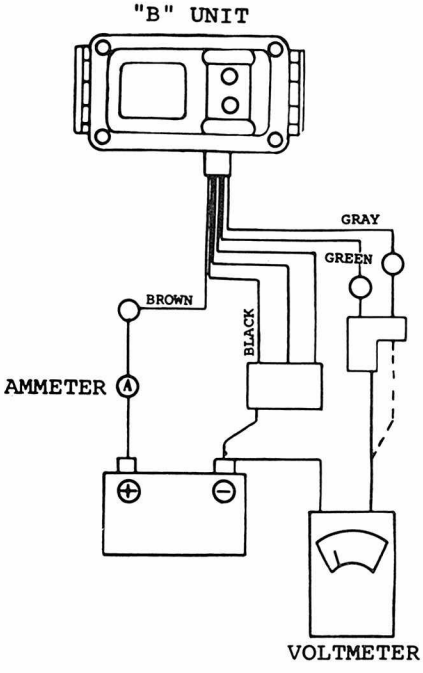


Fig. K3-11B — Connection points for "B" unit test. Unit should be making a steady buzz while testing.

an accurate ammeter and voltmeter. Connect a good, fully charged battery (12-12.5 volts) to "B" unit as shown in Fig. K3-11B, with ammeter installed in positive lead. Connect voltmeter to battery ground and to green wire. Check gray wire to ground voltage later. The ammeter should indicate 1.3-2.3 amps and should remain steady. Voltage indicated between green wire and ground should be 370-500 volts. Disconnect voltmeter lead from green wire and attach to gray wire. Voltage from gray wire to ground should also be 300-400 volts. The unit should make the tuning fork sound when checking.

LUBRICATION. The engine is lubricated by an automatic oil injection system. Two types are used. The "SUPERLUBE" system used on A1 models, sprays oil into the rotary valve covers between each carburetor and the rotary disc valve. With the "INJECTOLUBE" system used on A7, oil is sprayed into the inlet passage between each carburetor and rotary disc valve and oil is also pumped to the outer main bearings and crankpin bearings. The oil tank should be filled with two-stroke motor oil and should **never** be allowed to run dry. If the system is drained or pump unit is renewed, air should be bled from the system. Allow oil to flow from the oil line connections before attaching. Start engine and run at idle speed, then turn the pump control lever (L—Fig. K3-12) to the maximum position without moving the throttle. Pump and lines are primed when both exhaust pipes smoke excessively. Make certain that pump control cable enters groove in lever when lever is released.

To adjust the pump control cable, first adjust the idle speed and synchronize the carburetors as outlined in CARBURETOR paragraphs. With the throttle in idle position, adjust the oil pump control cable guide (A) until clearance (C) between control lever (L) and stop (S) is less than 0.02 inch. Make certain that the pump control lever begins to move immediately when the throttle slides begin to move. If the oil pump control cable is too loose, clearance (C) may be zero even when throttle slide is partially open resulting in not enough lubrication. Adjust the cable guide at hand lever until throttle hand lever has 0.08-0.024 inch free play at idle speed.

CLUTCH CONTROLS. The clutch is located on the right end of the transmission input shaft. Hand lever should have $\frac{5}{16}$-½ inch free play at the end of lever. Adjustment is accomplished by loosening lock nut (1—Fig. K3-14) and turning the adjusting screw (2) in until resistance is felt. Back the adjusting screw (2) out ¼-turn and tighten the lock nut. Adjust the cable guides at clutch cover end and at hand lever until the free play is $\frac{5}{16}$-½ inch at end of lever.

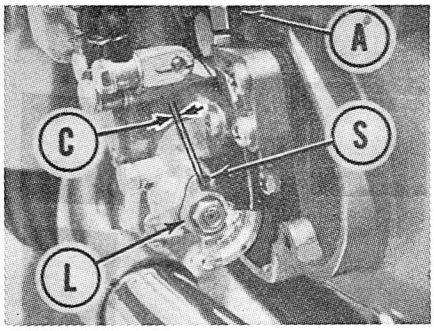


Fig. K3-12—View of the oil injection pump. When idle speed is correctly set, clearance (C) should be slightly less than 0.02 inch.

A. Cable guide
C. Clearance
L. Control lever
S. Stop

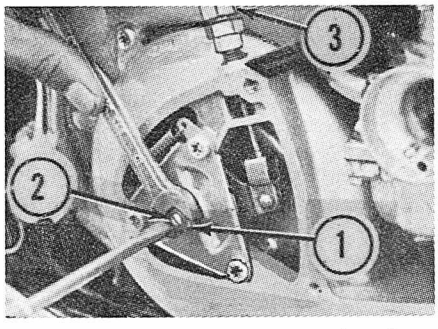


Fig. K3-14—View of the right side showing clutch adjustment. The locknut (1) must be loosened before turning the adjusting screw (2). The cable guide (3) is used to set the correct free play of hand lever.

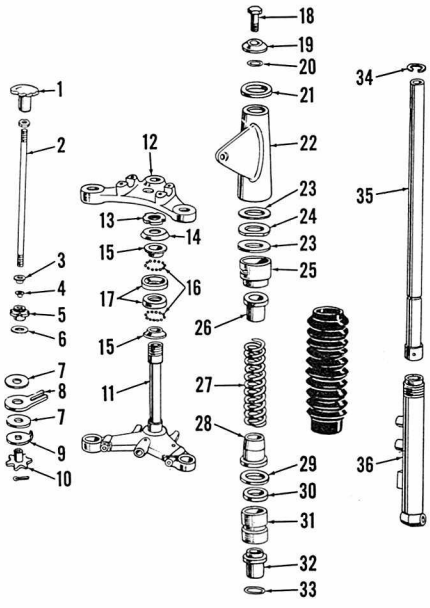


Fig. K3-15—Exploded view of the front suspension.

1. Friction knob
2. Rod
3. Washer
4. Bushing
5. Stem nut
6. Washer
7. Friction discs
8. Friction plate
9. Steel plate
10. Spring
11. Fork stem
12. Fork top
13. Lock nut
14. Cap
15. Bearing cone (2 used)
16. Bearing ball (19 used)
17. Bearing race (2 used)
18. Top (filler) screw
19. Washer
20. "O" ring
21. Cap
22. Cover
23. Washer
24. Gasket
25. Cover guide
26. Spring guide
27. Spring
28. Dust seal
29. Washer
30. Oil seal
31. Outer tube nut
32. Bushing
33. "O" ring
34. Snap ring
35. Inner tube
36. Outer tube

SUSPENSION. Each front suspension unit contains 200cc of oil. Oil used should be a mixture of 80% SAE 30 and 20% SAE 60.

Rear suspension units are not repairable and should be renewed if bent, leaking or damaged.

REPAIRS

PISTON, RINGS AND CYLINDER. The pistons can be removed after removing cylinders. Refer to the following specifications.

Ring end gap—
250cc .....0.006-0.018 in.
350cc .....0.006-0.0013 in.
Wear limit all models .....0.03 in.
Piston pin diameter .....0.63 in.
Clearance in piston..0.0002 in. Tight
0.0002 in. Loose
Clearance in rod
bearing .....0.0001-0.0009 in.
Wear limit ..... 0.004 in.
Piston shirt to cylinder clearance—
250cc .....0.001-0.002 in.
350cc .....0.003-0.004 in.
Wear limit all models .....0.006 in.

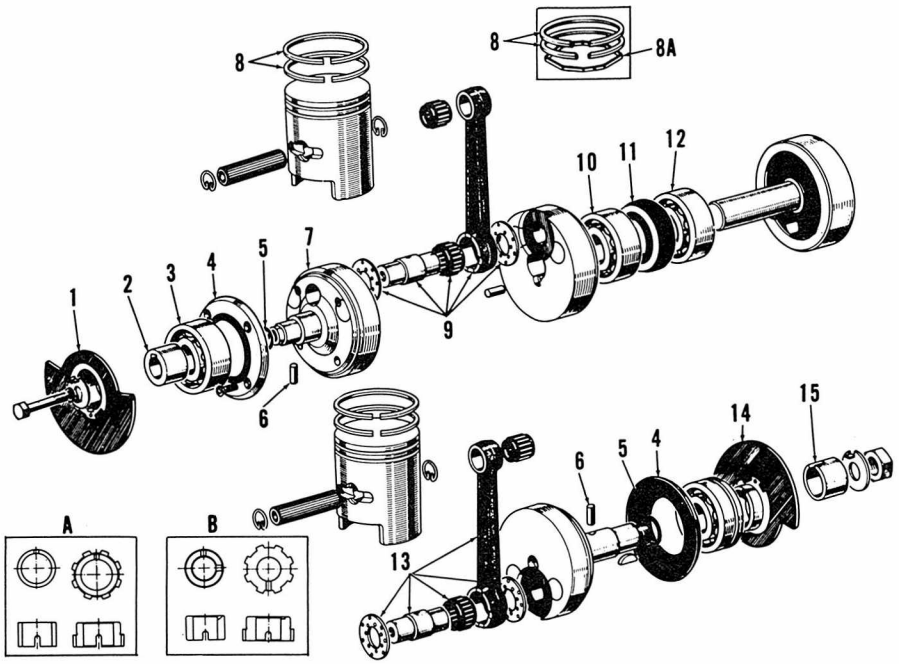


Fig. K3-16—Exploded view of A7 crankshaft assembly. Expander ring (8A) and oil receiver (4) are not used on A1 models. Replacement ring sets equipped with expander ring (8A) may be installed on early A7 pistons that originally did not have expander. Differences in late and early; left (A) and right (B) rotary valve collars may be seen.

1. Left rotary valve
2. Left valve collar (A)
3. Left bearing
4. Oil receiver (A7 only)
5. "O" ring
6. Locating pins
7. Left crank half
8. Piston rings
8A. Expander ring (A7 only)
9. Left crank overhaul set
10. Ball bearing
11. Seal
12. Ball bearing
13. Right crank
14. Right rotary valve
15. Right valve collar (B)

Piston skirt to cylinder clearance should be measured at right angles to piston pin. Pistons are available in standard size and two oversizes. The cylinders should be resized and new pistons fitted if taper or out of round exceeds 0.002 inch. Standard cylinder bore diameter is 2.09-2.0907 inches for 250cc models; 2.44-2.4407 inches for 350cc models. Compression pressure should be 134.9 psi. If compression is less than 99.4 psi, engine should be disassembled and checked.

Chrome plated piston ring should be installed in top groove. Piston must be installed with arrow on top aimed toward exhaust port (front). Piston should be heated before pressing the piston pin into piston. Cylinder and head retaining nuts should be tightened to 16 Ft.-Lbs. torque.

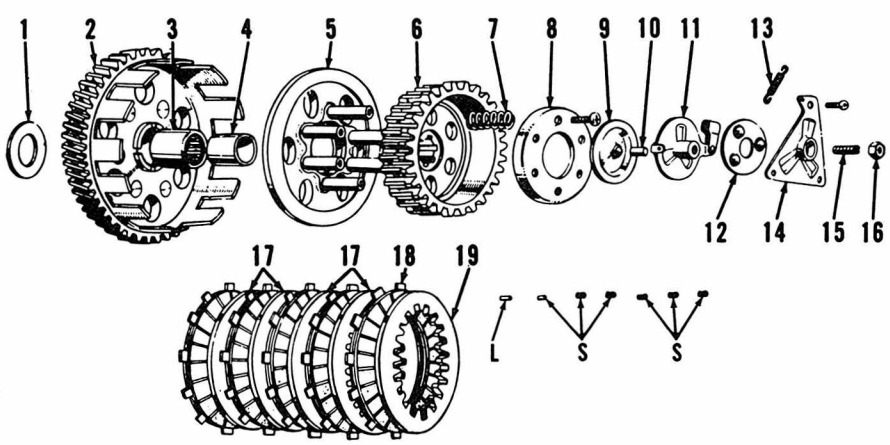


Fig. K3-17—Exploded view of clutch assembly. The clutch adjusting screw (15) is also shown in Fig. K3-14.

1. Thrust washer
2. Clutch drum
3. Bearing
4. Bushing
5. Pressure plate
6. Hub
7. Springs
8. Spring plate
9. Release bearing
10. Roller
11. Release lever
12. Release balls
13. Return spring
14. Cam plate
15. Adjusting screw
16. Lock nut
17. Driven plates (4 used on 250cc models, 5 used on 350cc models)
18. Friction discs (5 used on 250cc models, 6 used on 350cc models)
19. Outer plate (thicker)
L. Long return rubber (6 used)
S. Short return rubber (24 used for A1-30 used for A7)

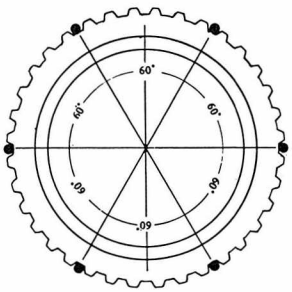


Fig. K3-17A — Return rubbers should be placed between friction discs at 60 degree intervals around clutch hub.

CONNECTING RODS AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. The crankshaft, connecting rods, center main bearings and center seal are available only as an assembly. Diametral clearance of connecting rod on crankpin should be 0.0008-0.0012 inch and wear limit should not exceed 0.008 inch. Crankshaft eccentricity should be less than 0.004 at center when supported between lathe centers at ends.

CLUTCH. The clutch can be removed after removing the right side carburetor and clutch cover. Refer to Fig. K3-17 and the following specification data.

A1 & A1SS (250cc) Models

Friction discs (18)—
Thickness .....0.156-0.164 in.
Wear limit .....0.14 in.
Clutch springs (7)—
Free length .....1.18 in.
Minimum limit .....1.10 in.

The gap between lugs on friction discs (18) and clutch drum (2) should be 0.002-0.012 inch. Renew the clutch drum and/or discs if clearance is excessive or drum is grooved. Return rubbers (L&S) are placed between friction discs to aid in disengaging the clutch. There are six long rubbers (L) which are installed next to the clutch hub. All A1 models use 24 short rubbers (S) and A7 models use 30 short rubbers (S). Refer to Fig. K3-17A for correct placement of return rubbers.

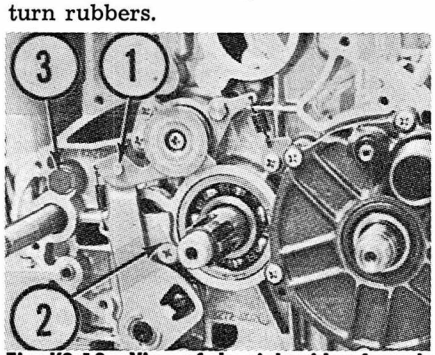
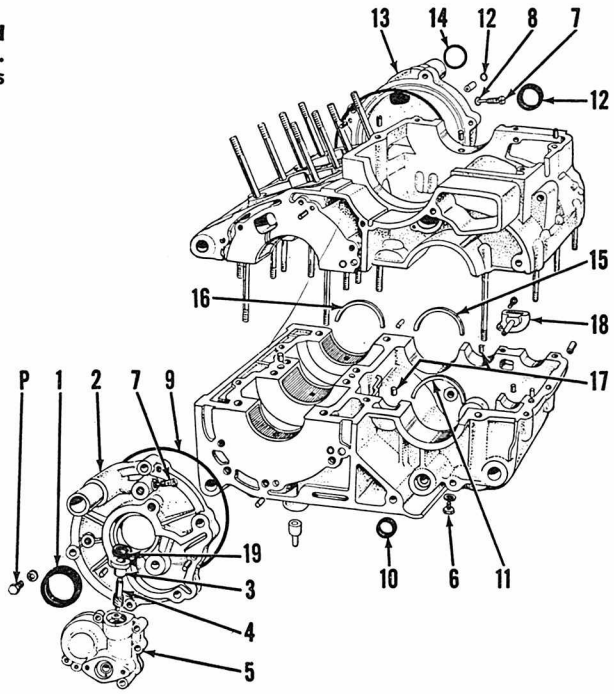


Fig. K3-18—View of the right side of crankcase showing the shift linkage (1), reservior (2) and kickstarter stop screw (3).

Fig. K3-19 — Exploded view of the crankcase. The timing hole plug is shown at (P).

1. Oil seal
2. Left rotary valve cover plate
3. Bushing
4. Tachometer drive gear
5. Oil pump and tachometer drive
6. Drain plug
7. Oil injection nozzle
8. "O" ring
9. "O" ring
10. Oil seal
11. Bearing set ring
12. Oil seal
13. Right hand valve cover
14. "O" ring
15. Bearing set ring
16. Bearing set ring
17. Bearing dowels
18. Oil reservoir
19. Oil seal



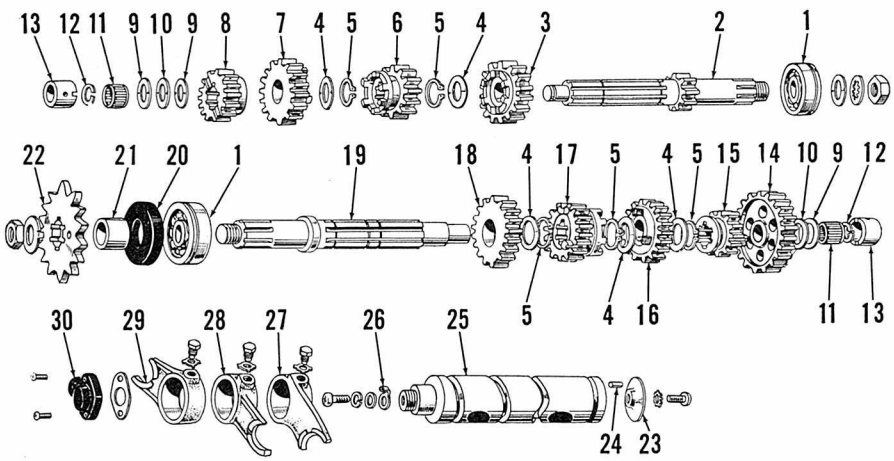


Fig. K3-20—Exploded view of the transmission assembly. Shift forks (28 & 29) are interchangeable.

1. Ball bearings
2. Input shaft & first gear
3. Fifth speed gear
4. Washer (25MM)
5. Snap ring
6. Sliding gear (3rd)
7. Fourth gear
8. Second gear
9. Washer (17MM)
10. Thrust washer
11. Needle bearing
12. Snap ring
13. Bearing race
14. First gear
15. Sliding gear (5th)
16. Third gear
17. Sliding gear (4th)
18. Second gear
19. Output shaft
20. Oil seal
21. Collar
22. Output sprocket
23. Plate
24. Shift pins (6 used)
25. Shift drum
26. Neutral indicator rotor
27. Shift fork
28. Shift fork
29. Shift fork
30. Neutral indicator switch

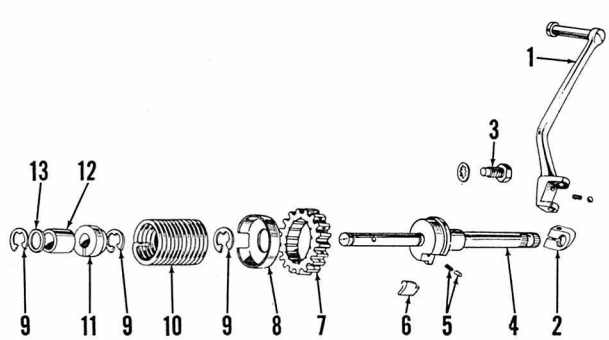


Fig. K3-21 — Exploded view of kickstarter.

1. Pedal
2. Pedal swivel
3. Stop screw
4. Drum and shaft
5. Plunger and spring
6. Pawl
7. Ratchet gear
8. Spring holder
9. Snap rings
10. Return spring
11. Spring guide
12. Shaft bushing
13. Washer (13MM)

CRANKCASE AND GEAR BOX. The crankshaft and transmission parts can be removed after the crankcase halves are separated.

To separate the crankcase halves, it is necessary to remove the carburetors and covers from both sides of the engine. Remove the alternator, clutch, shift linkage (1—Fig. K3-18), crankshaft gear, both rotary valve cover plates and rotary valve discs. Remove the oil reservoir (2) and the kick starter stop screw (3). Turn the engine assembly up side down and remove the sixteen stud nuts that attach the crankcase halves together. The lower crankcase can now be carefully lifted off, leaving the crankshaft, transmission and kick starter in the upper half.

Refer to Figs. K3-19, K3-20 and K3-21. The rotary valve discs should be 0.132-0.148 inch thick. If disc is less than 0.12 inch thick, valve should be renewed. The rotary valve cover plates (2 & 13—Fig. K3-19) should be renewed if scratched or worn to a depth of more than 0.146 inch.

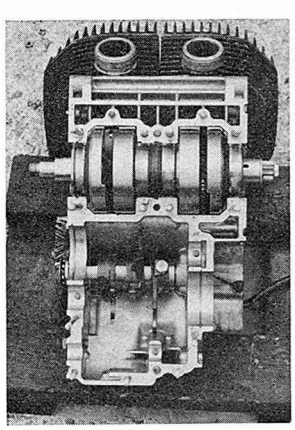
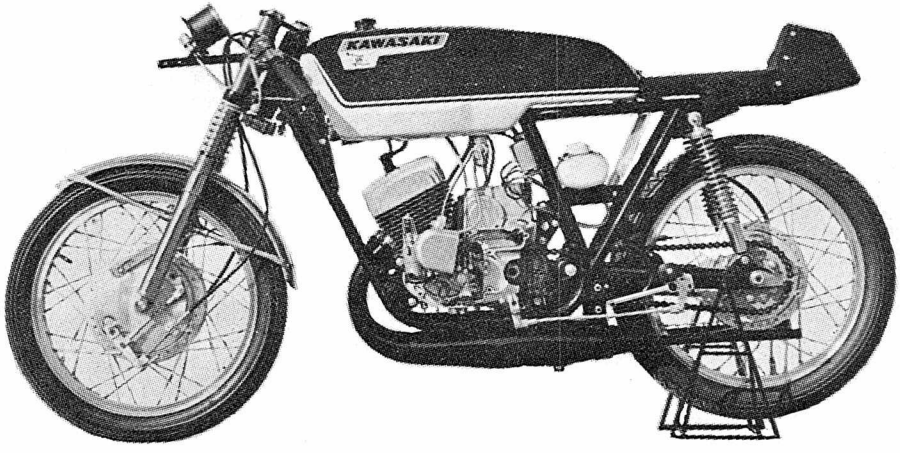


Fig. K3-22—View of A7 engine before installation of transmission and kick start assembly. Cases should be carefully cleaned before reassembly.

KAWASAKI A1-R AND A7-R

The A7-R and A1-R Road Racers have been developed from their street going counterparts; the A7 and A1. Construction is basic to all models with the exception of the information in the following paragraphs.



MODEL	A1-R Road Racer	A7-R Road Racer
Displacement-cc	247	349
Bore-MM	53	63
Stroke-MM	56	56
Number of cylinders	2	2
Oil-fuel ratio	1 to 15 plus oil pump	1 to 15 plus oil pump
Plug gap-inch	0.018-0.020	0.018-0.020
Point gap-inch	0.012-0.016	0.012-0.016
Ignition-		
Type	Magneto	Magneto
Timing-degrees BTDC	23	27
Tire size-front	2.75x18	2.75x18
Rear	3.00x18	3.00x18
Tire pressure (psi)-front	24	24
Rear	26	26
Rear chain free play-inch	⅝-⅞	⅝-⅞
Number of speeds	5	5
Weight-lbs. (approx.)	240	240

MAINTENANCE

SPARK PLUG. Normally NGK type B10EN spark plugs can be used; however, specific heat range should be chosen carefully. Electrode gap should be 0.018-0.020 inch (0.45-0.50MM). NGK type B8HN or B8HC spark plugs should be used to warm up engine.

CARBURETORS. Two racing carburetors are used with a remote float chamber for each. On 250 cc models Mikuni M26 carburetors are used; on 350 cc models Mikuni M29 carburetors are used. On all models, make certain that carburetors are perfectly synchronized to open exactly alike when the throttle grip is opened.

To adjust the float chambers, the rider should be mounted in normal riding position and all support (stands) should be removed from motorcycle. At this time, position the float chambers so that red points on side of main carburetor body are level with the red line on float chambers.

Carburetor specifications are subject to constant change therefore it is difficult to point out one set of specifications as correct for all circumstances. The following A1-R jet sizes may be used as a guide.

Main jet	#290
Jet needle	0-0
Needle jet	7H1-3
Cut-away	2.5MM
Pilot jet	#25
Air jet	#0.7
Pilot air screw opening	½ turn

IGNITION. The ignition system magneto is mounted and driven similar to the alternator used on A1 Samurai. Ignition timing for A1-R should occur at 23 degrees BTDC. Ignition on A7-R models should be timed for 27 degrees BTDC.

Ignition breaker point gap should be 0.012-0.016 inch (0.3-0.4MM) before changing the ignition timing. The breaker points should open as the piston reaches 0.110 inch (2.79MM) BTDC, on A1-R models. Points should open when piston is 0.151 inch (3.81 MM BTDC on A7-R models. Ignition timing should be checked and set for each cylinder and timing should be exactly alike.

LUBRICATION. The engine is lubricated by oil injection and oil mixed with the fuel. Recommended oil to fuel ratio is 1 to 15 when using "Castrol R30" or "Shell Super MX-100" and gasoline with at least 97 octane and low lead content. The same type of oil should be used in the "SUPER-LUBE" oil injection tank. The oil injection should use approximately 1 quart every 100 miles. The oil pump lever is normally ⅓ open; however, it may be opened between ⅓ to ½ depending on conditions.

The clutch and transmission are lubricated by multi-grade SAE 10W-30 automotive oil.

CLUTCH CONTROLS. The clutch controls are adjusted the same as A1 Samurai models except that the adjusting screw (2—Fig. K3-14) should be backed out ½ turn (not ¼ turn).

SUSPENSION. Type and quantity of oil in the front suspension will depend on various conditions. Normal capacity is 200cc for each unit on A1-R models and 220cc on A7-R models. Oil used can be mixture of 20% SAE 60 spindle oil and 80% SAE 30 motor oil.

The rear shock absorbers can be adjusted to one of three settings to meet the conditions. Both must be set the same.

SPECIAL NOTES. The front brake has two panels, each with two leading shoes. It is important that all four shoes contact drum at exactly the same time.

Be extremely careful when servicing with fuel and oil. Filters should be used when filling to prevent foreign matter from entering tanks.

If possible, screws and nuts should be safety wired to prevent loosening. The oil and fuel lines should be attached using appropriate clamps and safety wire.

The drive chain and all cables should be lubricated before each race.

REPAIRS

PISTONS, RINGS AND CYLINDERS. Cylinder heads, head gaskets, cylinders, pistons and rings are different than standard models. Rings are 1MM thick. The clearance between the piston and cylinder should be checked by measuring piston diameter at bottom of skirt in line with arrow on top of piston. Clearance should be 0.0022-0.0026 inch (0.055-0.065MM) when first assembling.

When breaking in, use the following procedure: 1. Ride for 5 minutes in fourth or fifth gear at a constant 7,000 RPM. 2. Ride for at least 5 minutes at a constant 8,000 RPM. 3. Remove cylinder heads, cylinders and pistons and check for any polished surfaces on piston. If piston contacts cylinder wall it will be polished. Smooth any polished surface of piston carefully with #400 or #600 sandpaper. Clean thoroughly then reassemble. 4. Ride for 5 minutes in fifth gear at a constant 9,000 RPM. 5. Ride for 2-3 minutes in fifth gear at full throttle. 6. Again remove the pistons and check for any polished surfaces on pistons and smooth with sandpaper. Also, check the chassis and engine for loose nuts or screws.

CONNECTING RODS AND CRANKSHAFT. The crankshaft and connecting rods are similar to standard parts; however, parts are not interchangeable. The rotary valve discs are not interchangeable. The left valve disc is marked "L" and the right valve disc is marked "R". Be sure they are correctly installed. The hexagon headed screw with an oil passage must be installed in the upper front hole in the rotary valve cover plates. These screws should be installed using a 6MM gasket between valve cover plate and the crankcase and a plain washer between the head of screw and cover plate.

CLUTCH. The clutch is similar to standard models except that one more friction disc (18—Fig. K3-17) and one more driven plate (17) is used. Clutch drum (2), friction discs (18) and springs (7) are not interchangeable with standard models.

CRANKCASE AND GEAR BOX. Crankcase service procedures are similar. Only the input shaft second gear (8—Fig. K3-20) and third gear (16) on the output shaft are interchangeable with standard models. It is recommended that gears be renewed as a complete set rather than individually. The 24MM snap rings on bearings should be renewed when disassembled. The sharp edged side of snap rings (5) should be toward washers (4).

CHECK LIST. The following is a recommended check list before riding:

1. Injection oil-quantity
2. Fuel-oil mixture (15:1 ratio)-quantity
3. Choke lever-fully open
4. Throttle valves-synchronized
5. Front and rear wheels-aligned and balanced
6. Tires-air pressure and wear
7. Spokes-loosening
8. Brakes-operation and play
9. Drive chain-play
10. Rear shock absorbers-same position
11. Front & rear suspension-operation
12. Safety wires and pins-firmly attached

KAWASAKI
125, 175, 250 AND 350 CC SINGLE CYLINDER MODELS

MODEL	F5	F6	F7	F8
Displacement-cc	346	124	174	246.8
Bore-MM	80.5	52	61.5	68
Stroke-MM	68	58.8	58.8	68
Number of cylinders	1	1	1	1
Lubrication method	Oil Injection			
Plug gap-inch	0.060	0.024	None*	0.024
Point gap-inch	None	0.012-0.016	None	0.012-0.016
Ignition type	CDI	Magneto	CDI	Magneto
Timing-degrees BTDC	23@6000	23	23@6000	20
Electrical system voltage	6	6	6	6
Tire size-Front	3.00x21	3.00x18	3.00x19	3.25x19
Rear	4.00x18	3.25x18	3.50x18	4.00x18
Tire pressure-Front	24 PSI	23 PSI	23 PSI	24 PSI
Rear	31 PSI	28 PSI	28 PSI	31 PSI
Rear chain free play-inch	¾	¾	¾	¾
Number of speeds	5	5	5	5
Weight-Lbs. (approx.)	265	231	233	270

*Surface gap spark plug.

MAINTENANCE

SPARK PLUG. Refer to the following chart for recommended spark plug application:

	NGK	Champion
F5	B-10H	L-19V
Electrode Gap	0.060 inch	Surface Gap
F6	B-9HC	L78 or L-3G
Electrode Gap	0.024 inch	0.024 inch
F7	BUHX	L-20V
Electrode Gap	Surface Gap	Surface Gap
F8	B-8HC	L-81 or L-6G
Electrode Gap	0.024 inch	0.024 inch

CARBURETOR. A Mikuni sliding valve carburetor is used on all models. Ignition timing should be checked before making any carburetor adjustments. Check starter cable for ⅛ inch free play at lever on handle bar. Cable has adjustment points at control lever and under fuel tank. The following specifications are

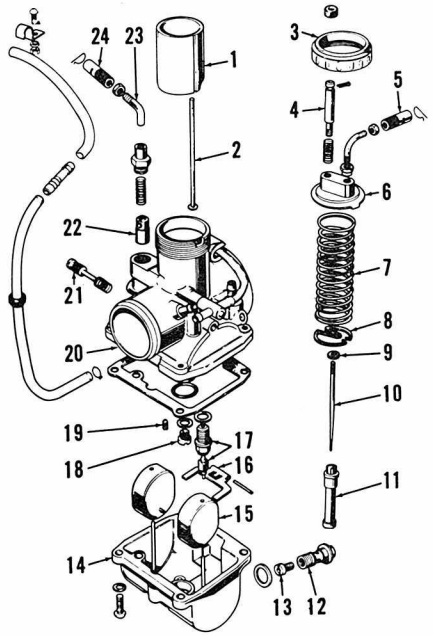


Fig. K4-1—Exploded view of typical carburetor used on F5 and F8 models.

1. Throttle slide
2. Throttle stop rod
3. Mixing chamber cap
4. Throttle stop screw
5. Throttle cable adjuster
6. Mixing chamber top
7. Throttle return spring
8. Spring seat
9. Jet needle clip
10. Jet needle
11. Needle jet
12. Main jet plug
13. Main jet
14. Float bowl
15. Float
16. Float lever arm
17. Float valve
18. Needle jet setter
19. Pilot jet
20. Carburetor body
21. Idle air screw
22. Starter plunger
23. Cable guide
24. Start cable adjuster

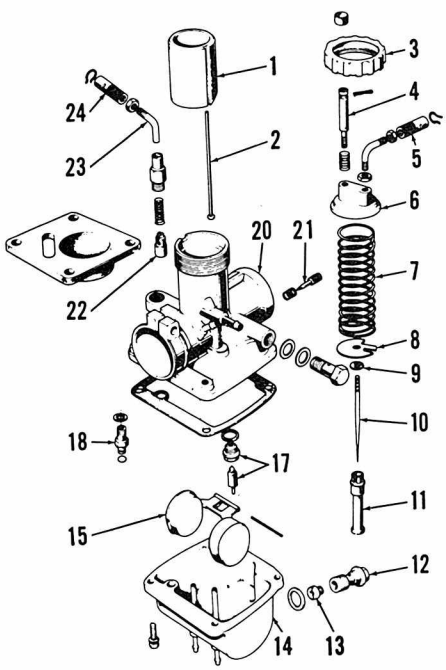


Fig. K4-2—Exploded view of typical carburetor used on F6 and F7 models. Pilot jet is pressed into lower surface of body (20). Refer to Fig. K4-1 for legend.

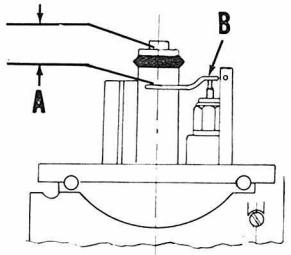


Fig. K4-3—Float level (A) is adjusted by bending tang (B) in center of float arm. Make certain that both arms are of equal height.

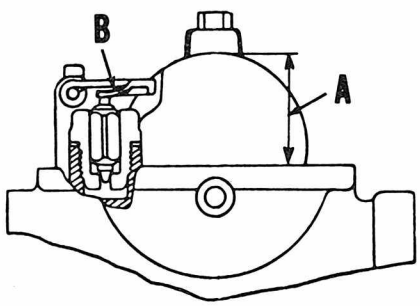


Fig. K4-4—Float level (A) is adjusted by bending tang (B) on F6 and F7 models.

standard. Refer to Fig. K4-1 for F5 and F8 models and Fig. K4-2 for F6 and F7 models.

F5 Carburetor model .....VM 32-SC
Main jet (13) 125.5
Needle jet (11) 0-8
Jet needle (10) .....5 EJ 8
Pilot jet (19) 35
Throttle valve (1) 2.5
Air screw (21) turns out 1¼
F6 Carburetor model .....VM 24 SC
Main jet (13) 125
Needle jet (11) 0-4
Jet needle (10) .....4 J 13
Pilot jet 30
Throttle valve (1) 2.5
Air screw (21) turns out 1¾
F7 Carburetor model .....VM 26 SC
Main jet (13) 105
Needle jet (11) 0-2
Jet needle (10) .....4 EJ 3
Pilot jet 30
Throttle valve (1) 2.5
Air screw (21) turns out 1¾
F8 Carburetor model .....VM 30 SC
Main jet (13) 117.5
Needle jet (11) 0-8
Jet needle (10) .....5 FL 9
Pilot jet (19) 30
Throttle valve (1) 2.5
Air screw (21) turns out) 1¾

Clip (9) in second groove from top of needle (10) on F8 models and in third groove on all other models. Idle stop (4) should be adjusted to provide an idle speed of 1300-1500 RPM on F6 models and 1000-1300 RPM on all other models.

Dimension (A—Fig. K4-3) should be ½ inch on models with float separate from arm (F5 and F8). Float level (A—Fig. K4-4) on F6 and F7 models should be $1\frac{3}{32}$ inch (28 MM). On all models, adjustment is accomplished by bending tang (B—Fig. K4-3 or Fig. K4-4).

Main jet may be changed on all models by removing plug from carburetor cover and then removing plug (12) and main jet (13).

Make certain that vent line (D—Fig. K4-7 is not crimped or obstructed as this will cause flooding.

IGNITION AND ELECTRICAL. All models are equipped with a 6 volt battery and a rectifier to convert AC current to DC for battery charging and lights.

Energy transfer magneto ignition is used on F6 and F8 models; Capacitor Discharge Ignition (CDI) is used on F5 and F7 models. The ignition charging coil and breaker points (F6 & F8 models) or trigger coil (F5 & F7 models) are located under the flywheel. The ignition high tension coil is located on frame under fuel tank on all models. The CDI control box is located under the seat, next to the oil tank on F5 and F7 models.

On F6 and F8 models, breaker point maximum gap should be set to 0.012-0.016 inch and ignition timing is changed by varying gap within these limits. Timing marks are located on crankcase and flywheel similar to marks shown in Fig. K4-5. Timing can be checked with engine stopped. When flywheel is turned in normal direction of rotation, breaker points should just open as timing marks (A&B) are aligned.

Timing on F5 and F7 models can only be checked with a power timing light. Marks (A&B) should align at 4000 RPM. Timing may be adjusted by moving base plate that ignition coils are mounted on beneath flywheel. Clockwise movement will advance timing.

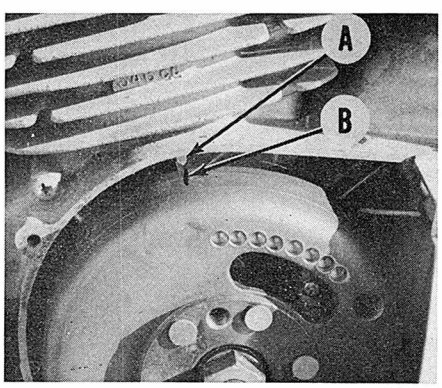


Fig. K4-5—With engine running at 4000 RPM, timing marks (A&B) should appear with the aid of a power timing light. NOTE: An additional spark may cause seizure, refer to text.

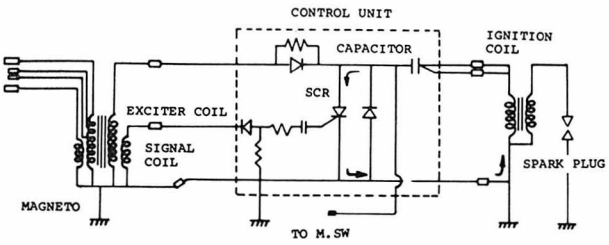


Fig. K4-6 — Simplified diagram of CDI system used on F5 and F7 models.

Explanation and Inspection of CDI. (Fig. K4-6) As the magneto rotor turns a current is set up in the ignition charging (exciter) coil. This current is diode rectified and used to charge the capacitor in the control unit (CDI box). A current is also produced in the trigger (signal) coil. This trigger signal, on striking the SCR (thyristor), releases the charge stored in the capacitor to the high tension coil. Position of the trigger coil, in relation to the magneto flywheel, determines ignition timing.

Some checks possible on the CDI system include checking resistance across the trigger coil (smallest of three coils on magneto stator) and resistance in the charging coil (mounted directly beneath the trigger coil). Proper resistance between red/white wire and black wire on charging coil is 250 ohms ±10%. Proper resistance between blue wire and black wire on trigger coil is 75 ohms ±10%.

Ignition coil should check 0.21 ohms ±10% between green/white wire and black wire and 1.8 ohms ±10% between the high tension lead and black wire.

Kawasaki has a special service tester to check operation of the CDI control box. A check possible without the service tester may be done with a power timing light. Marks (A&B—Fig. K4-5) should align at 4000 RPM. Move timing light 180 degrees around flywheel and observe timing mark (B) on flywheel at this point. Slowly check the remainder of the flywheel circumference for additional ignition locations. Any ignition location other than 23 degrees Before Top Dead Center and 23 degrees Before Bottom Dead Center is abnormal and may cause engine seizure. The CDI box is faulty and should be renewed if ignition occurs at other than 23 degrees BTDC and 23 degrees BBDC.

A solid state voltage regulator (located beneath fuel tank) is used in the system. Regulator should maintain voltage to battery at 7.0± 0.5 volts. A damaged regulator may overcharge the battery or dump all current from alternator, making starting difficult and plug fouling probable.

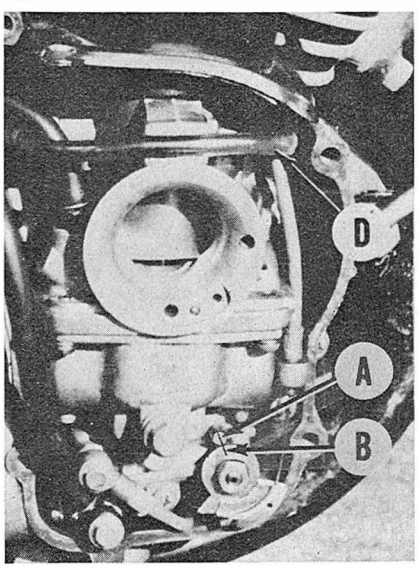


Fig. K4-7 — Marks (A&B) should align when throttle is in idle position on F6, F7 and F8 models.

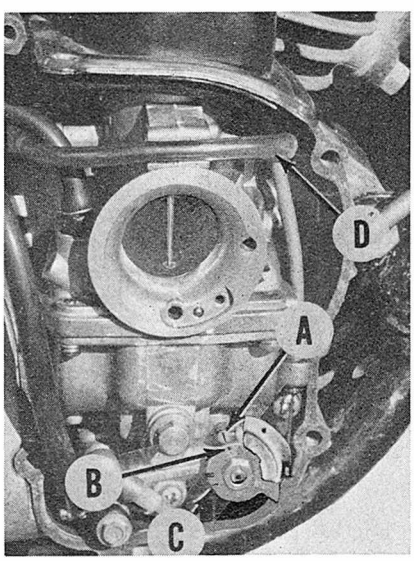


Fig. K4-7A—Oil pump adjustment on F5 models should be checked with throttle wide open. Align dot (B) with mark (A) on oil pump, disregard mark (C) used to check alignment on other models.

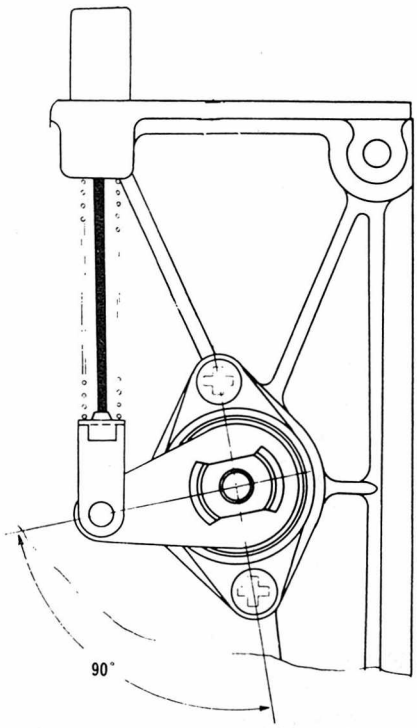


Fig. K4-8—View of clutch release arm with cable adjusted correctly.

LUBRICATION. Recommended transmission lubricant for all models is SAE 10W/30 motor oil or ATF. Capacity of F5 and F8 models is 41 oz F6 and F7 models require only 24 oz. of lubricant in gear box. Oil should be maintained between two marks on dipstick with dipstick screwed in and motorcycle in a vertical position. Renew transmission fluid at 2000 mile intervals.

The engine is lubricated by an automatic oil metering system that meters oil in direct relation to the amount of throttle opening. Only oils recommended for use in two cycle air cooled engines should be used. If allowed to run dry, oil system must be bled of all air. Loosen oil inlet line and allow oil to flow until air is no longer present in oil seeping from fitting. Remove air from pressure lines by running engine at idle and holding pump lever in full on position until thick smoke is coming from exhaust.

Oil pumps on F6, F7 and F8 models should be adjusted so that marks (A&B—Fig. K4-7) are aligned with throttle in the idle position. Oil pump on F5 models should be adjusted with throttle wide open. Dot (B—Fig. K4-7A) should align with mark (A) at this point. Slack should be taken from throttle cables on all models before oil pump adjustment is made. Cable adjusters are located under fuel tank.

Note: If tachometer stops working, oil pump should be checked carefully because oil pump is driven from tachometer gear.

CLUTCH CONTROLS. Remove drive sprocket cover and turn cable adjuster beneath fuel tank to obtain 90 degree angle (Fig. K4-8) in release arm. Reinstall cover and remove rubber plug on F5 and F8 models or magneto cover on F6 and F7 models.

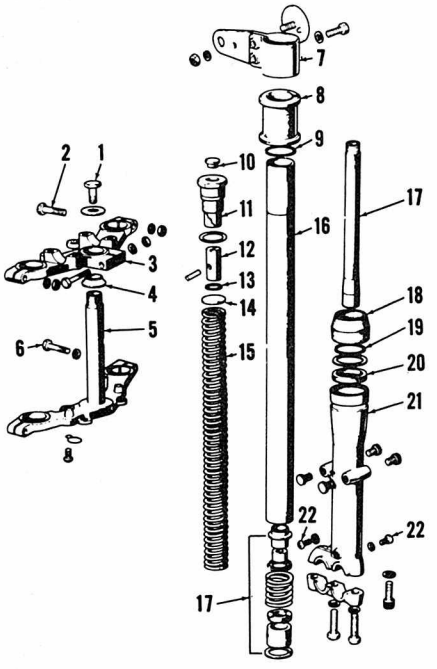


Fig. K4-9—Exploded view of F5 front suspension unit. Other units are similar.

1. Steering head bolt
2. Fork pinch bolt
3. Steering head
4. Bearing cone
5. Steering stem
6. Fork pinch bolt
7. Head light holder
8. Damper rubber
9. Retaining clip
10. Rubber plug
11. Fork top bolt
12. Adjuster
13. "O" ring
14. Spring seat washer
15. Fork spring
16. Inner fork tube
17. Fork cylinder assembly
18. Dust shield
19. Retaining clip
20. Oil seal
21. Outer fork tube
22. Oil drain screw

Loosen lock nut (1—Fig. K4-10) and back out adjusting screw (2) until loose. Turn screw in until a slight resistance is felt and then back it out ¼-½ turn and tighten lock nut (1). Adjust cable to obtain ⅛ inch free play in clutch lever pivot on handle.

SUSPENSION. Forks on F5, F7 and F8 models may be adjusted by varying the front axle location, internal spring tension and steering stem height in relation to fork tubes. Many variations are possible but generally speaking, the farther forward the axle, the quicker the steering. Rearward movement of axle will make steering slow thus more stable at high speed. To change tension of internal spring, remove plug (10—Fig. K4-9) and turn adjuster (12) with screwdriver. Pin through adjuster engages detents in top bolt (11) to change tension. Make certain that both fork tubes are adjusted the same. Rough riding conditions normally require a stiff spring action.

Front forks on F6 models are adjustable only in steering stem to fork location. After loosening triple clamp bolts, fork tubes may be moved up or down in steering head. Locating the steering stem down on fork tubes will quicken steering and reduce high speed stability.

Oil used in front forks should be a mixture of 65% SAE 30 motor oil and 35% SAE 60 spindle oil. Refer to the following for fork oil capacities:

F5	175cc each
F6	170cc each
F7	115cc each
F8	175cc each

Rear suspension units are adjustable to five different positions depending on rider preference. Units are not repairable and should be renewed if leaking or damaged.

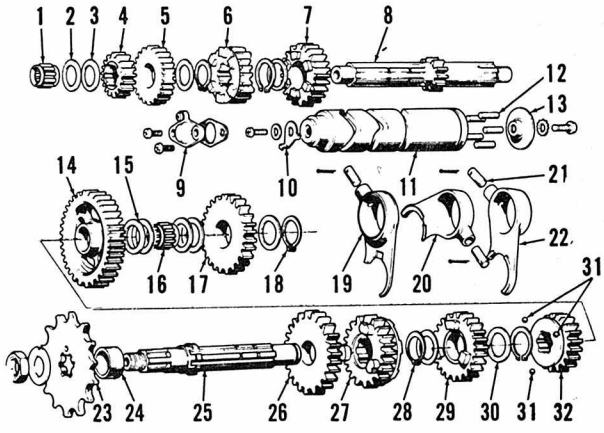


Fig. K4-11 — Exploded view of F6 & F7 type transmission. Gear shift forks (19 & 20) are identical parts.

1. Needle bearing
2. Thrust washer
3. Thrust washer
4. Second drive gear
5. Fourth drive gear
6. Third drive gear
7. Fifth drive gear
8. Drive shaft
9. Neutral switch cover
10. Neutral switch rotor
11. Shift drum
12. Locating pins
13. Change drum plate
14. First output gear
15. Thrust washer
16. Needle bearing
17. Kick idle gear
18. Snap ring
19. Shift fork
20. Shift fork
21. Shift fork guide pin
22. Shift fork
23. Drive sprocket
24. Engine sprocket collar
25. Output shaft
26. Second output gear
27. Fourth output gear
28. Snap ring
29. Third output gear
30. Lock washer
31. 5/32 Steel ball
32. Fifth output gear

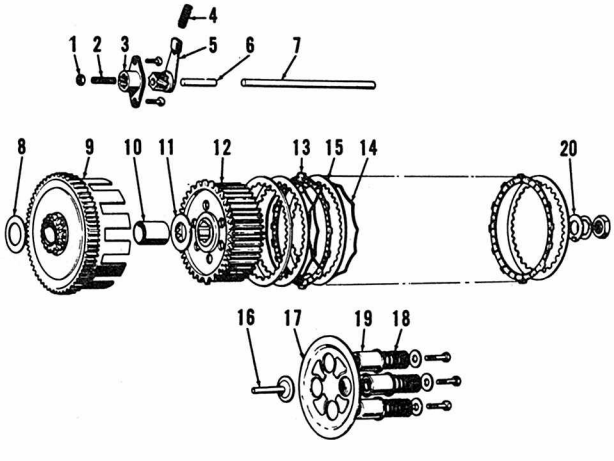


Fig. K4-10 — Exploded view of F5 clutch and actuating parts. Other units are similar.

1. Lock nut
2. Adjusting screw
3. Release lever base plate
4. Release spring
5. Release arm
6. Push rod
7. Push rod
8. Thrust washer
9. Clutch boss and primary gear
10. Bushing
11. Thrust washer
12. Clutch hub
13. Friction disc
14. Steel ring
15. Steel plate
16. Spring plate pusher
17. Spring plate
18. Clutch spring
19. Spring guide
20. Punched lock washer

REPAIRS

CYLINDER, HEAD AND PISTON. Cylinder and piston may be removed without dismounting engine from frame. Refer to the following repair specifications:

Maximum cylinder taper or out of round ..... 0.002 inch
Ring end gap ..... 0.008-0.012 inch
Piston skirt to cylinder clearance—
F5 ..... 0.0035 inch
F6 and F7 ..... 0.0028 inch
F8 ..... 0.0024 inch

Install pistons with arrow on dome toward front of engine (exhaust side). Install piston rings with markings on top side. Top piston ring has more depth than lower rings and should not be interchanged. Place expander ring in lower groove before installing outer ring. DO NOT place expander in top ring groove. Piston pin should be a snug **hand** fit in piston. Renew piston pin retaining clips after each usage. Measure piston ⅛ inch from bottom at a right angle to pin hole for cylinder clearance check.

Use of three or more head gaskets is recommended in F5 models to obtain 120-125 PSI compression.

Head should be torqued using a cross pattern. Tighten large nuts first to a torque of 25 foot pounds and then tighten small bolts to 14 foot pounds on F5 and F8 models. F6 and F7 head bolts should be torqued to 14 foot pounds.

CRANKSHAFT AND CONNECTING ROD. Crankcase halves must be separated to remove crankshaft assembly. Maximum eccentricity of crankshaft is 0.004 inch with crankshaft supported on "V" blocks. Clear-

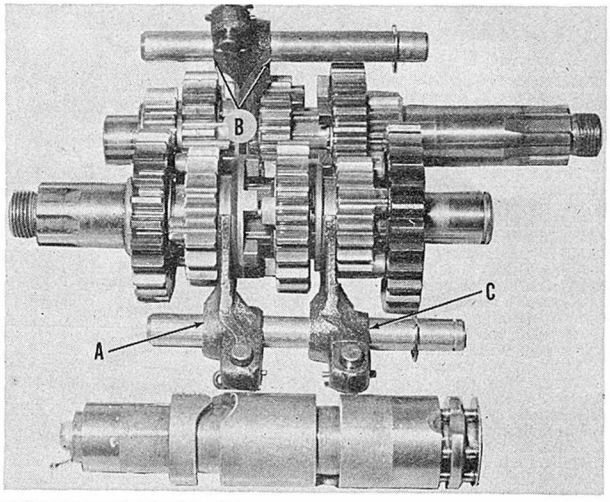


Fig. K4-12—Arrangement of transmission gears in typical F5-F8 unit. Shift forks are identical on F8 models but must be reinstalled correctly on F5 models (See text).

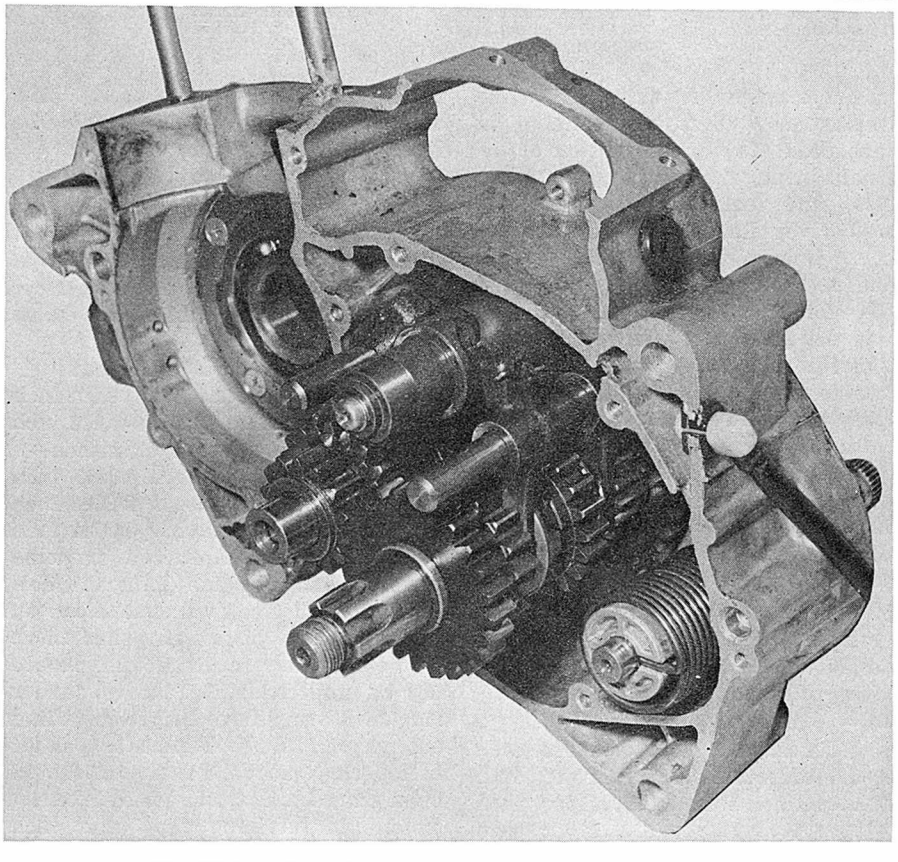


Fig. K4-13—View of gear installation typical of F5 and F8 models.

ance between large end of connecting rod and crank cheek should be 0.0098-0.012 inch.

Torque nut that retains flywheel to 70 foot pounds.

CLUTCH. Clutch is a wet multi-disc unit operated by push rods running through the drive shaft of transmission. Clutch is similar for all models except for the number of plates installed. Refer to Fig. K4-10 and the following specifications:

Standard friction disc (13) thickness—

F5	0.11 inch	(2.8 MM)
F6	0.16 inch	(4.0 MM)
F7	0.12 inch	(3.0 MM)
F8	0.11 inch	(2.8 MM)

Minimum friction disc thickness—

F5	0.10 inch	(2.5 MM)
F6	0.15 inch	(3.7 MM)
F7	0.11 inch	(2.7 MM)
F8	0.10 inch	(2.5 MM)

Standard clutch spring (18) free length—

F5	1.42 inch	(36.0 MM)
F6	1.36 inch	(34.5 MM)
F7	1.36 inch	(34.5 MM)
F8	1.32 inch	(33.6 MM)

Minimum clutch spring free length—

F5	1.36 inch	(34.5 MM)
F6	1.30 inch	(33.0 MM)
F7	1.30 inch	(33.0 MM)
F8	1.27 inch	(32.2 MM)

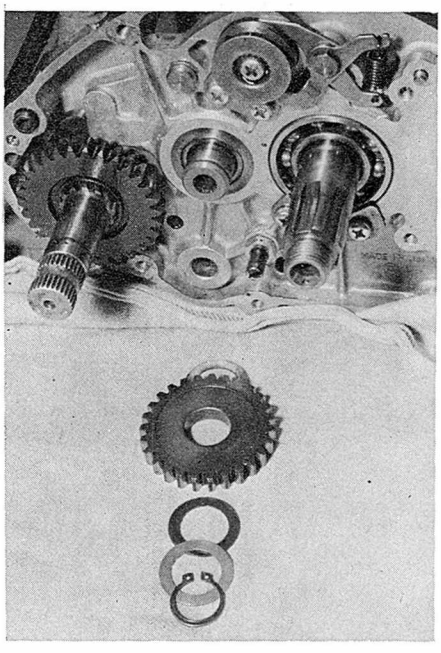


Fig. K4-14—Arrangement of thrust washers on kick starter idle gear on F5 model. F8 does not have washer beneath gear. 175 and 125cc models have two thrust washers under gear as shown in Fig. K4-11.

Check push rods (6 & 7) to make certain they are not bent. F6 models do not have steel rings (14) and clutch primary drive gear is removable.

CRANKCASE AND GEARBOX. Transmission may be removed after separating the crankcase halves.

Steel balls (31—Fig. K4-11) are used as neutral detent only on F6 and F7 models. Use a light grease to locate balls in shaft grooves while assembling fifth gear (32). Make certain that steel balls correctly engage the three cut outs in gear. On all models, transmission and shift drum must be placed in right engine case as a unit. Refer to Fig. K4-12 and K4-13 for proper arrangement of gears. Shift forks (A, B & C—Fig. K4-12) are identical on F8 models but are machined differently on F5 models and must be installed correctly. Second and third gear shift fork is milled at (A). Fourth and fifth gear shift fork is left unmachined (B) and first gear shift fork is flycut at (C).

F5 and F7 models are equipped with a fuel pumper valve (Fig. K4-15). The fuel pumper valve is used to remove any accumulation of fluid (water or fuel) from bottom of carburetor cover. If diaphragm (B) is ruptured (as in A), valve will pass foreign material to crankcase and cause damage to bearings and cylinder. In the event that a new diaphragm is not available, a gasket

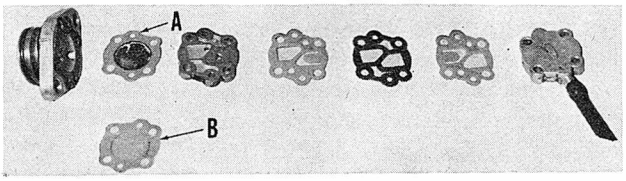


Fig. K4-15 — Exploded view of fuel drain pump used on F5 and F7 models. It is harmful to engine if operated with a ruptured diaphragm.

should be fabricated to completely seal unit. Operation with unit sealed will not impair performance, but the possibility of flooding exists.

SPEED TUNING

The F81M is the competition version of the F8 Enduro. Many design features and tune up specifications of the F81M may be incorporated in standard F8 parts to increase the performance of this model.

A speed kit is available from Kawasaki to increase performance of the 350cc F5 (Big Horn). Many standard F5 parts may be modified to meet F5 Speed Kit specifications.

Also listed in this section are some speed tuning recommendations for the 125cc F6.

Any modification of standard parts or installation of high performance parts will void the manufacturers warranty.

F6 (125CC) Models

IGNITION. Standard magneto should be removed. A racing magneto (Kawasaki part #21002-005) is recommended. Ignition should occur as piston reaches 2.50 MM (0.098 inch) BTDC.

CARBURETOR. A standard F7 (175cc) carburetor is recommended. The following jet sizes are suggested for use in the 26 MM unit:

Main jet 107.5
Throttle valve 2.5
Pilot jet 35
Needle jet 0-2
Jet needle .....4 EJ 3

Initial setting for pilot air screw as 1½ turns out from a lightly seated position.

CYLINDER AND CYLINDER HEAD. Head should be milled to obtain a compression ratio of 8.5:1. Milling 2 MM (0.078 inch) from head and remachining 15 degree taper in edge of combustion chamber will attain desired volume of head (10cc). It may be necessary to remove more than 0.078 inch to obtain desired volume.

Only cylinder modification suggested is to raise top of exhaust port 2 MM (0.078 inch). This will bring top of port to 33 MM (1.299 inch) from top of cylinder.

The rotary valve cover used on F6 models will accept the F7 carburetor without modification. Rotary valve should be cut to open 5 degrees earlier than standard and close 10 degrees later than standard. Intake should begin 120 degrees BTDC (115 degrees standard) and close 65 degrees ATDC (55 degrees standard).

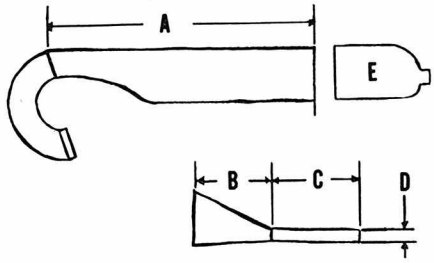


Fig. KT4-1 — Performance of F6 Enduro models may be improved by modifying the standard exhaust pipe.

A. 380MM (14.96 inch)
B. 155MM (6.102 inch)
C. 200MM (7.874 inch)
D. 21MM (0.826 inch)
E. Rear of standard exhaust pipe

EXHAUST SYSTEM. The standard F6 muffler may be modified to improve performance. NOTE: This modification is recommended for units that will be operated off road exclusively.

Remove section of tail pipe 380 MM (14.960 inch) from seam of header pipe (Fig. KT4-1). Install cone and stinger assembly as shown. Stinger should be 21 MM (0.826 inch) in diameter and 200 MM (7.87 inch) long. Rear cone should be 155 MM (6.102 inch) in length.

F5 (350CC) Models

IGNITION AND ELECTRICAL. Remove all lights and voltage regulator. Connect blue, black and white/red wire from magneto to CDI control box. Black/white wire from control box may be connected to a kill switch. All other wires from magneto should be left disconnected and secured out of the way.

CARBURETOR AND INDUCTION SYSTEM. The F5 Speed Kit is equipped with a VM 32 SC carburetor with a #145 main jet installed.

Rotary valve cover and right crankcase half should be matched so that passageway is free of steps or other obstructions. Rotary valve used in the F5 Speed Kit has a 35 degree longer duration than the standard rotary valve (Fig. KT4-2).

A high capacity air filter is installed in the F5 Speed Kit carburetor cover. A standard cover may be drilled and a speed kit filter element installed.

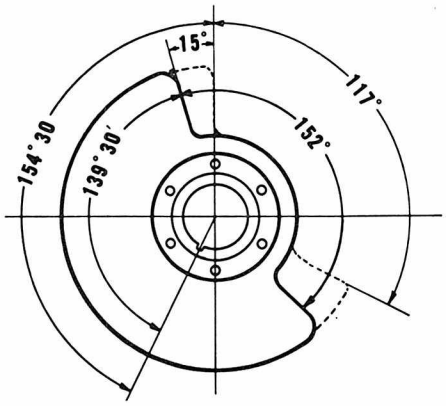


Fig. KT4-2—Solid line represents outline of F5 Speed Kit and F81M rotary valve. Configuration of standard F5 and F8 rotary valve is shown by dotted lines.

LUBRICATION. A 15:1 fuel-oil mix should be used for competition. Oil pump and oil tank should be left intact but oil pump control cable should be removed. Allow pump to operate in idle position. Same type of oil should be used in fuel mix as is used in oil metering system.

CYLINDER, HEAD AND PISTON. Standard Big Horn cylinder head is used with the speed kit.

A two ring piston is used with a recommended cylinder clearance of 0.0039-0.0043 inch. Both rings used are same size as standard top piston ring. Standard ring end gaps should be used.

Major difference in the F5 Speed Kit cylinder is the location and size of the exhaust port. Kit exhaust port is 40.2 MM (1.582 inch) from top of cylinder. Standard port is 44 MM (1.732 inch) from top of cylinder. Width of exhaust port is unchanged, as are all other ports however, exhaust port is 3 MM (0.118 inch) taller than standard.

EXPANSION CHAMBER. The F5 Speed Kit is equipped with an expansion chamber.

F81M (250CC) Models

IGNITION AND ELECTRICAL. Standard recommended spark plug for the F81M is an NGK type B-9HC.

A special racing magneto is fitted and ignition is timed to occur 19 degrees BTDC. Cylinder head should be removed and piston position checked with a dial gage to adjust ignition timing. Piston will be 0.093 inch (2.35 MM) BTDC at correct position for ignition. Timing may be adjusted by moving breaker point base plate.

CARBURETOR. The F81M is equipped with a VM 30 SC Mikuni

sliding valve carburetor. Refer to the following standard F81M carburetor specifications:

Main jet .....#130
Jet needle E5
Needle jet 0.6/2
Pilot jet .....#40
Throttle valve 2.5
Starter jet .....#60

Initial setting of pilot air screw is 1¼ turns out from a lightly seated position.

LUBRICATION. Gear box capacity of F81M models is approximately 1 quart (34 oz.) A high quality of SAE 30 motor oil or ATF should be used and should be renewed after every 100 hours of operation.

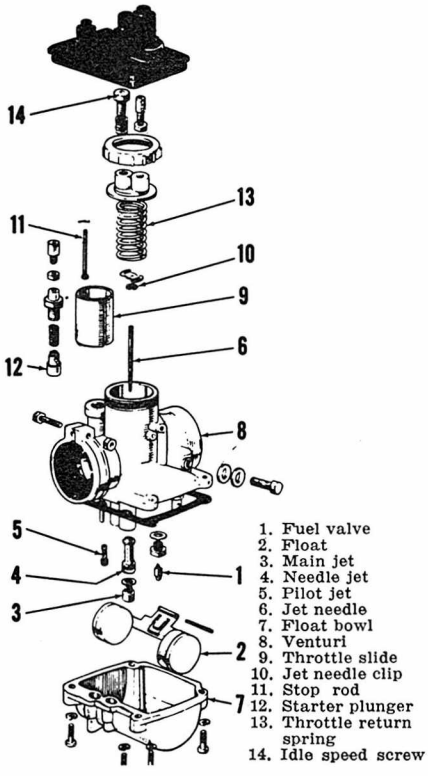
Engine lubrication is done entirely by the fuel-oil mix used in the fuel tank. Oil intended for use in air cooled two cycle engines should be mixed with 16-20 parts gasoline to one part oil.

PORT TIMING. Transfer ports on F81M models are timed at 59 degrees as are standard F8 transfer ports. The exhaust port on the F81M is positioned to open 87 degrees 40 minutes before and after BDC. Standard F8 exhaust opens 83 degrees before and after BDC. Rotary valve is shaped so that intake opens 130 degrees BTDC and closes 65 degrees ATDC. The difference between a standard F8 rotary valve and the F81M rotary valve may be seen in Fig. KT4-2.

KAWASAKI
GA2, G3 AND G4 SINGLE CYLINDER MODELS

MODEL	GA2	G3SS G3TR90	G31M	100E G3TR100 G4TR
Displacement-cc	89	89	99	99
Bore-MM	47	47	49.5	49.5
Stroke-MM	51.8	51.8	51.8	51.8
Number of cylinders	1			
Oil-fuel ratio	Oil Injection	Oil Injection	1:20	Oil Injection
Plug gap-inch	0.024-0.027			
Point gap-inch	0.012-0.016			
Ignition timing	Fixed			
Piston position BTDC-inch	0.077	0.077	0.103	0.077
Electrical system voltage	6	6	.....	6
Tire size-Front	2.50x18	2.75x18	3.25x18	3.00x18
Rear	2.50x18	2.75x18	3.25x18	3.00x18
Rear chain free play-inch	¾	¾	¾	¾
Number of speeds	5	5	5	5*
Weight-lbs. (approx.)	174	183	178	185

*G4 TR and 100E models are also equipped with 2 speed secondary transmission.



1. Fuel valve
2. Float
3. Main jet
4. Needle jet
5. Pilot jet
6. Jet needle
7. Float bowl
8. Venturi
9. Throttle slide
10. Jet needle clip
11. Stop rod
12. Starter plunger
13. Throttle return spring
14. Idle speed screw

Fig. K5-1—Basic Mikuni sliding valve carburetor is common to all models.

MAINTENANCE

SPARK PLUG. An electrode gap of 0.024 inch is recommended for all models. A type B-7HZ NGK plug is recommended for normal use in all street models. Model G31M requires a racing type B-8HN. For extended hard use in other models, a NGK type B-8HC is recommended.

CARBURETOR. Refer to Fig. K5-1 for exploded view of typical Mikuni sliding valve carburetor used on all models. Idle air screw on front of carburetor should be 1½ turns out from a lightly seated position on all models except the 100E, G4TR and 100cc G3TR which require 1¾ turns out. Refer to Fig. K5-1 and the following standard specifications:

G3TR, GA2 AND G3SS (90cc)
Carburetor model .....VM 19 SC
Main jet (3) .....#160
Needle jet (4) E-4
Pilot jet (5) .....#17.5
Jet needle (6) .....5 I 2

G4TR, 100E AND G3TR (100cc)
Carburetor model .....VM 19 SC
Main jet (3) .....#180
Needle jet (4) E-6
Pilot jet (5) .....#17.5
Jet needle (6) ..... 5 I 1

G31M (100cc)
Carburetor model .....VM 24 SC
Main jet (3) .....#180
Needle jet (4) 0-6
Pilot jet (5) .....#35
Jet needle (6) ..... 4 DG 6

Clip (10) should be in third groove from top of needle (6). Float level (A—Fig. K5-2) should be set at 0.83-0.94 inch (21-24 MM) on all models and is adjusted by bending tang (B).

IGNITION AND ELECTRICAL. Models equipped with lights use an alternator and rectifier to produce current for battery charging, indica-

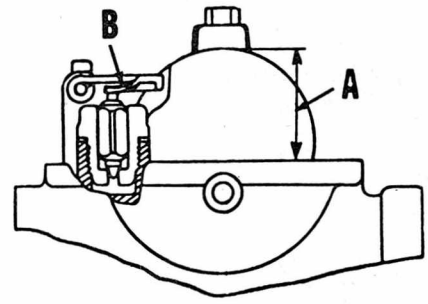


Fig. K5-2—Float level (A) should be 21-24MM and is adjusted by bending tang (B). Float bowl gasket should be removed when checking.

tor lights and horn. Head and tail light are operated by AC current from the alternator.

Ignition points should be set to a maximum gap of 0.012-0.016 inch on all models.

Ignition should occur (points just open) as piston reaches 0.103 inch (2.58 MM) BTDC on G31M models. A mark on the magneto rotor will align with a mark on the contact breaker base plate at this time. Ignition on all other models should occur as piston reaches 0.077 inch (1.96MM) BTDC. Timing marks (B&C—Fig. K5-3) will align as crankshaft passes correct position for ignition. It will be necessary to remove the left engine cover to view timing marks on all models. G4TR and 100E models are equipped with a two speed transmission on left engine case that must be removed before case may be removed (Refer to CRANKCASE AND CRANKSHAFT section).

Timing on G31M models may be adjusted by moving contact breaker base plate. All other models have points located beneath flywheel on a stationary base plate. Timing may be adjusted slightly by varying point gap within the specified limits. Flywheel must be removed to renew contact breaker assembly on all models except G31M.

LUBRICATION. Recommended transmission lubricant is SAE 30 motor oil. Capacity is 0.74 qt. and fluid should be renewed every 1800 miles. Maintain oil level between two marks on dipstick with dipstick screwed in and motorcycle in vertical position.

Oil used for engine lubrication should be type recommended for use in air cooled two cycle engines only. G31M models require a 20:1 fuel to oil mixture in fuel tank. A recently overhauled G31M should use a 16:1 fuel to oil ratio. All other models are lubricated by an automatic oil metering system. Oil from tank is pumped and metered to the rotary valve cover in amounts porportionate to degree of throttle opening.

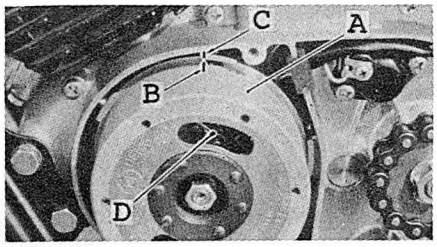


Fig. K5-3—Point gap may be set by reaching through hole (D) in flywheel (A). Timing marks (B&C) will align when crankshaft is in correct position for ignition.

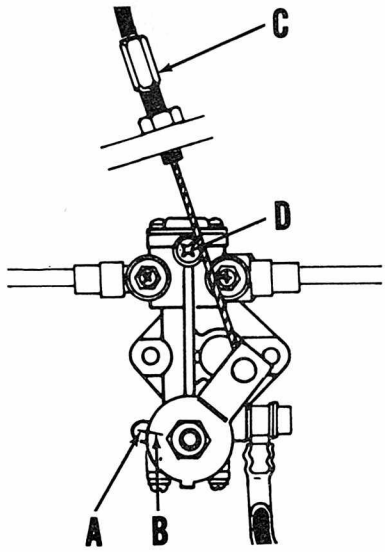


Fig. K5-4—Turn cable adjuster (C) to obtain proper alignment of marks (A&B).

Aligning marks (A&B—Fig. K5-4) should be aligned when throttle is in idle position. On units with no aligning marks, pump control arm should move full against stop at idle position. In either case, oil pump control arm and throttle slide should begin to move at same instant.

Pump must be bled if removed or allowed to run dry. Loosen bolt that secures oil line from tank to oil pump. Oil should be allowed to flow until air is no longer present in oil coming from fitting. After tightening all bolts, start engine and allow it to idle while holding oil pump control arm in full ON position. Run engine in this manner until thick smoke is coming from exhaust.

CLUTCH CONTROLS. Turn clutch cable adjusters at both ends to obtain maximum slack. Remove carburetor cover and loosen lock nut (C—Fig. K5-6). Turn cable adjuster (B) until

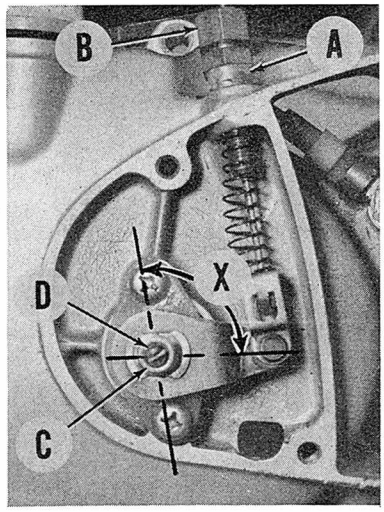


Fig. K5-6—Turn cable adjuster (B) to obtain 90-100 degree angle (X). Refer to text for adjustment of screw (D).

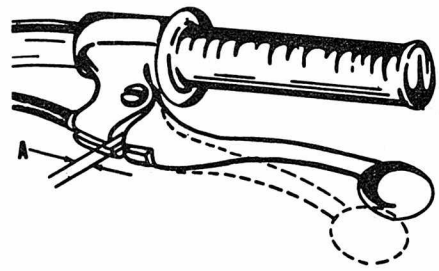


Fig. K5-7—Adjust clutch cable to obtain ⅛ inch free play at pivot (A).

a 90-100 degree angle is formed (X) between the release arm and base plate. Back adjusting screw (D) out until loose then turn it in slowly until a slight resistance is felt. Back screw (D) out ¼ turn and tighten lock nut (C). Turn cable adjusters to obtain ⅛ inch free play in pivot of control lever (A—Fig. K5-7).

SUSPENSION. GA2, G3TR and G3SS models require 130cc of a mixture of 80% SAE 30 motor oil and 20% SAE 60 spindle oil in each front suspension unit. Oil is used in G31M, G4TR and 100E front fork tubes should be a mixture of 65% SAE 30 motor oil and 35% SAE 60 spindle oil. G31M units require 170cc each; G4TR and 100E units require 170cc of oil each.

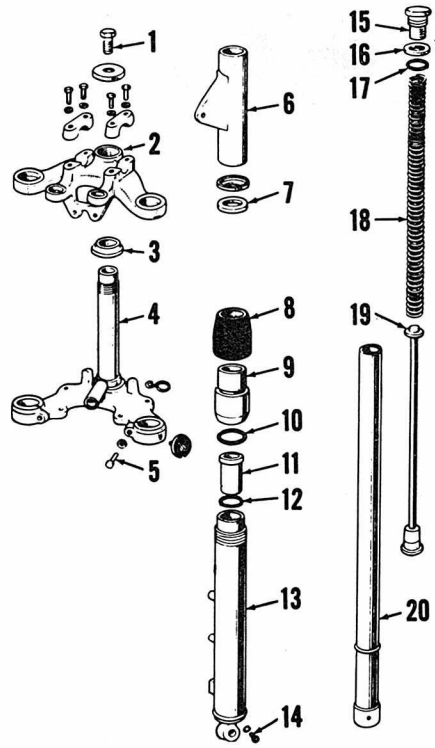


Fig. K5-8—Exploded view of G4TR front suspension unit. Others are similar.

1. Steering stem bolt
2. Steering head
3. Bearing cone
4. Steering stem
5. Fork tube pinch bolt
6. Head light holder
7. Gasket
8. Dust shield
9. Outer tube nut
10. "O" ring
11. Tube guide
12. Oil seal
13. Outer fork tube
14. Oil drain screw
15. Fork top bolt
16. Washer
17. "O" ring
18. Fork spring
19. Fork spring holder
20. Inner fork tube

Forks may be disassembled by clamping the outer tube nut (9—Fig. K5-8) in a vice and turning lower tube (Fig. K5-9). Care should be taken to prevent damage to outer tube nut.

Rear suspension units are not repairable and should be renewed if leaking or damaged.

REPAIRS

PISTON, RINGS AND CYLINDER. Cylinder and piston may be removed without dismounting engine from frame. Refer to the following repair specifications:

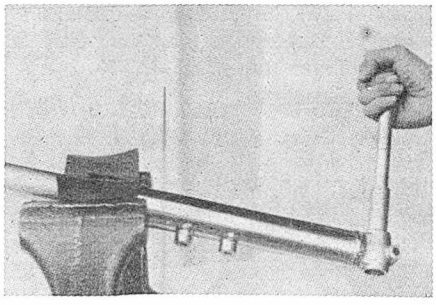


Fig. K5-9—Hold outer tube nut in a vise and turn the outer tube to disassemble.

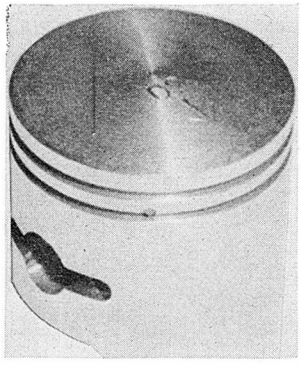


Fig. K5-10—Pistons are usually installed with the arrow on dome toward front HOWEVER, piston ring locating pins must always be toward rear of engine.

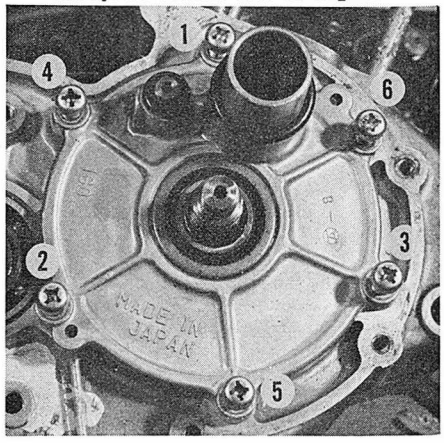


Fig. K5-11—Rotary valve cover should be tightened in sequence shown. Check condition of seals and "O" rings in cover.

Piston ring end gap..0.008-0.012 inch
Piston skirt to cylinder clearance
G31M .....0.0036 inch
All others .....0.0014 inch
Maximum cylinder taper or
out of round .....0.002 inch

Pistons are usually installed with the arrow on dome toward front (exhaust port) HOWEVER, piston ring locating pins must always be toward rear of engine. All rings are installed with markings on the top side. Chrome ring belongs in top groove. Measure piston skirt $\frac{3}{32}$ inch from bottom at a right angle to pin hole for cylinder clearance check. Pistons are available in standard and two oversizes for all models except the G31M. G31M is equipped with a hard chrome plated cylinder and should not be honed or overbored. Use a cross pattern and torque head to 8.5-11 Ft. Lbs.

CRANKCASE AND CRANKSHAFT. Crankcase halves must be separated to remove the transmission and crankshaft. Crankshaft should not be disassembled unless proper tools are available to correctly reassemble. Maximum crankshaft runout is 0.0012 inch. Connecting rod side clearance should be 0.0098-0.012 inch.

Care should be taken to prevent rotary valve from drying out or absorbing water. Check rotary valve for wear or damage and coat liberally with two cycle engine oil before reinstallation. Inspect seals in rotary valve cover for tears or cracks. Use sequence (Fig. K5-11) to tighten rotary valve cover retaining screws.

Inspect transmission for worn or broken teeth and worn shift forks. Cotter pins in shift forks must be installed correctly (Fig. K5-13) or heads of cotter pins will bind shifting mechanism in case.

A two speed gear box is mounted at outboard end of output shaft on G4TR and 100E models. Place the selector in "L" position and remove the four screws that secure cover.

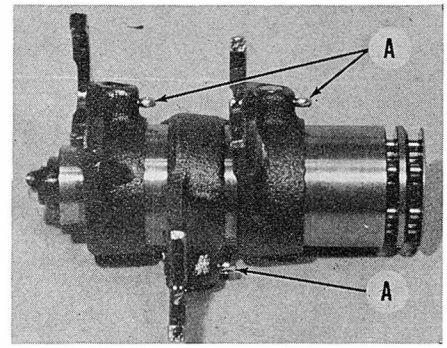


Fig. K5-13 — Note position of cotter pin heads (A) on shift forks. Tangs must be bent flat.

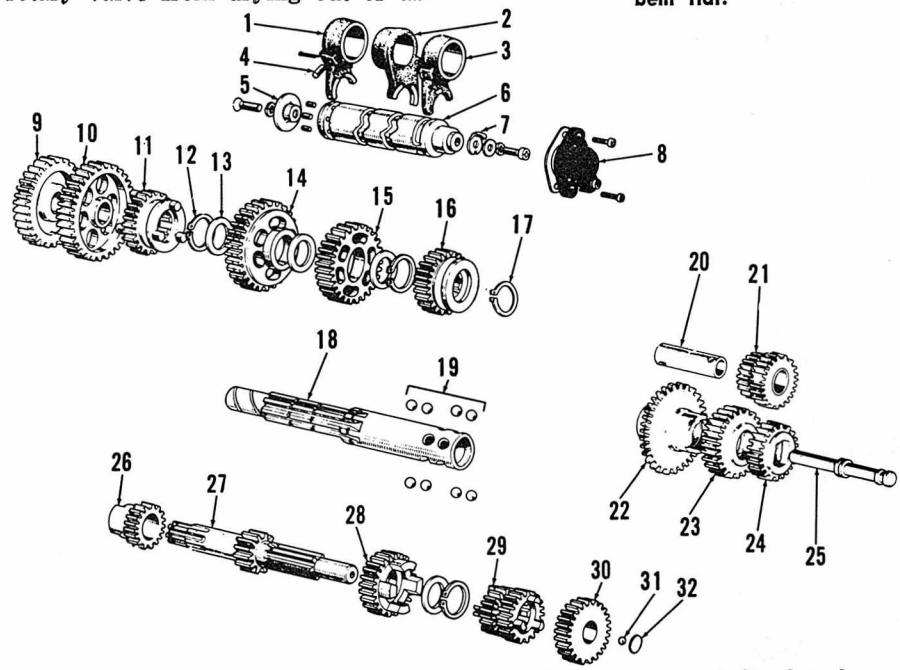


Fig. K5-12—Exploded view of G4TR transmission. Other units are similar but do not have two speed gear box (20 thru 25) and enlarged output shaft (18).

1. Low and second shift fork
2. Fourth and fifth shift fork
3. Third shift fork
4. Shift fork guide pin
5. Change drum pin plate
6. Change drum
7. Neutral switch
8. Neutral switch cover
9. Kick idle gear
10. Output shaft first gear
11. Output shaft fourth gear
12. Snap ring
13. Thrust washer
14. Output shaft second gear
15. Output shaft third gear
16. Output shaft fifth gear
17. Snap ring
18. Output shaft
19. Steel balls (8 required)
20. Counter shaft
21. Counter gear
22. Drive sprocket (15 teeth)
23. High gear
24. Low gear
25. Shift rod
26. Kick pinion
27. Drive shaft
28. Fourth drive gear
29. Second and third drive gear
30. Fifth drive gear
31. 7/32 steel ball
32. Drive shaft thrust plate

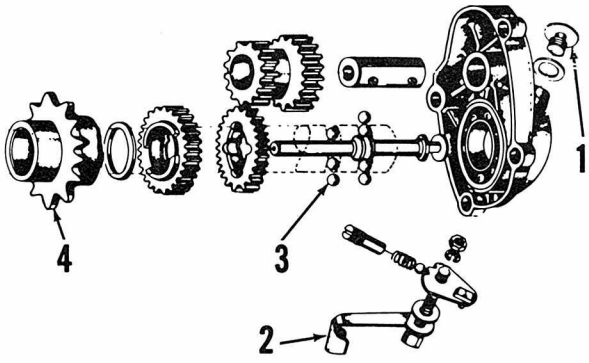


Fig. K5-14 — Exploded view of two speed gear box used on G4TR and 100E models.

1. Filler plug
2. Selector lever
3. Steel balls (8)
4. Drive sprocket

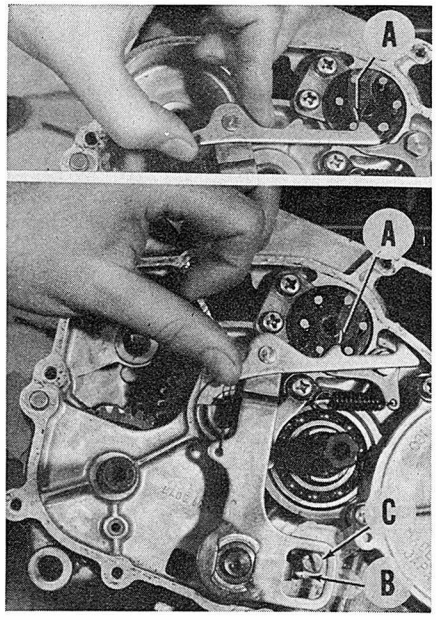


Fig. K5-15—Clearance (A) must be equal and is adjusted by loosening lock nut (B) and turning eccentric pin (C). Remove return spring while making adjustment.

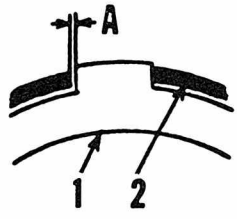


Fig. K5-16—Renew clutch discs if clearance (A) exceeds 0.012 inch.

1. Friction disc
2. Clutch boss

Tap cover lightly and slide off of dowels. CAUTION: Do not lose the eight balls (19—Fig. K5-12). Gears and shift parts may be serviced after the small cover is removed. The large (left) cover must be removed to withdraw sprocket. One of the screws attaching side cover is located in two speed gear box compartment beneath the idler gear assembly. When assembling, a light grease may be used to hold balls in place. Fill gear box to level of plug (1—Fig. K5-14) with same lubricant as main transmission. Capacity of two speed gear box is approximately 90cc.

Refer to Fig. K5-15 for proper adjustment of shift stop pin. Pin installed on GA2 and early G3 models is not eccentric and has no adjustment.

CLUTCH. A wet multi-disc type clutch is used on all models. A snap ring on the transmission shaft is used to secure clutch.

Friction disc standard thickness is 0.13 inch. Discs should be renewed if less than 0.12 inches thick. Friction discs should also be renewed if gap between clutch primary boss and discs (A—Fig. K5-16) exceeds 0.012 inch. Standard clearance is 0.0016 inch. Standard clutch spring free length is 0.87 inch and springs should be renewed if they measure 0.79 inch or shorter.

SPEED TUNING

G31 M timing specifications are as follows:

Exhaust port timing—
Open .....87 degrees ATDC
Closes .....87 degrees BTDC
Transfer port timing—
Open .....118 degrees ATDC
Closes .....118 degrees BTDC
Rotary valve timing—
Open .....140 degrees BTDC
Closes .....70 degrees ATDC

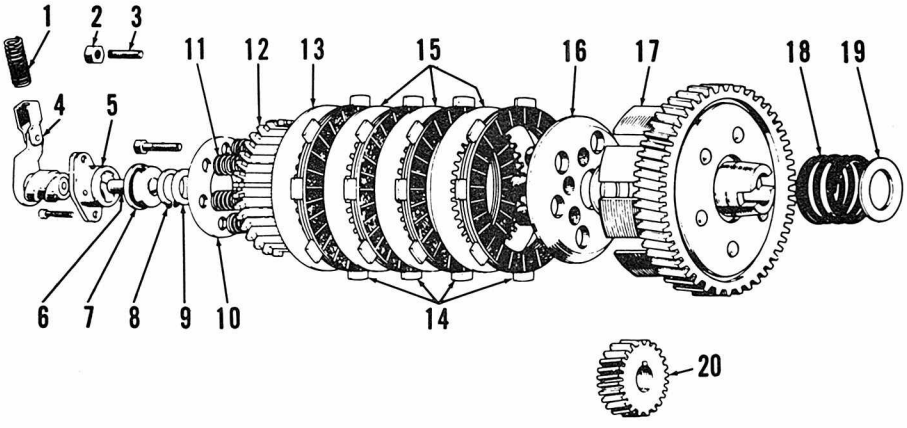


Fig. K5-17—Clutch and actuating parts common to all models.

1. Release spring
2. Lock nut
3. Adjusting screw
4. Release arm
5. Release base plate
6. Dowel pin
7. Pusher plate
8. Snap ring
9. Thrust washer
10. Spring holder
11. Clutch spring
12. Clutch hub
13. Outer clutch plate
14. Friction discs (4)
15. Steel plates (3)
16. Clutch wheel
17. Clutch boss & primary gear
18. Thrust spring
19. Thrust washer
20. Primary pinion gear

KAWASAKI
THREE CYLINDER MODELS

MODELS	Mach II* S2	Mach III H1	Mach IV H2*
Displacement-cc	346	498	748
Bore-MM	53	60	71
Stroke-MM	52	58.8	63
Number of cylinders	3	3	3
Oil-Fuel ratio	———	Oil Injection	———
Plug gap-inch	0.024	None (CDI)	0.040
Point gap-inch	0.012-0.016	None (CDI)	None (CDI)
Ignition type	Battery	CDI**	CDI**
Ignition timing	23°	25°	23°
Piston position BTDC-inch	0.102	0.136	———
Electrical system voltage	12	12	12
Battery terminal grounded	Negative	Negative	Negative
Tire size-Front	3.00x18	3.25x19	3.25x19
Rear	3.50x18	4.00x18	4.00x18
Tire pressure-Front	24 PSI	28 PSI	28 PSI
Rear	31 PSI	32 PSI	32 PSI
Rear chain free play-inch	1	1	1
Number of speeds	5	5	5
Weight-Lbs. (approx.)	329	383	422

*Data included for the H2 and S2 models is preliminary only.
**Capacitor Discharge Ignition.

MAINTENANCE

SPARK PLUG. Recommended spark plug for the S2 is an NGK type B-9HC with an electrode gap of 0.024 inch. Recommended spark plug for use in 500cc models is an NGK type BUHX or a Champion type UL-19V. In an emergency, an NGK type B-9HC with a 0.040 gap may be used in an H1.

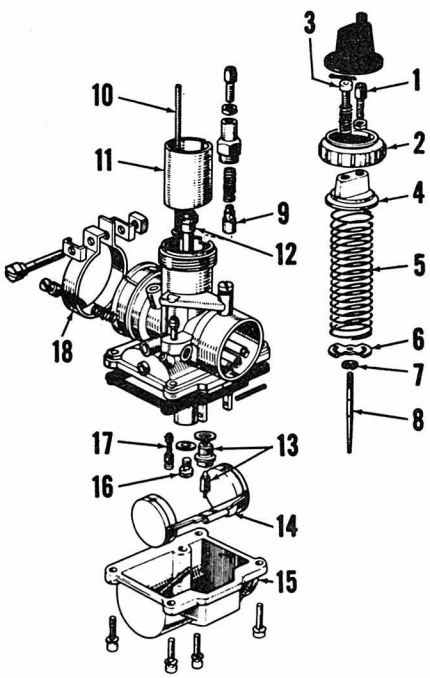


Fig. K6-1—Exploded view of Mikuni sliding valve carburetor used on the Mach III.

1. Throttle cable adjuster
2. Mixing chamber cap
3. Throttle stop adjuster
4. Mixing chamber top
5. Throttle return spring
6. Spring seat
7. Jet needle clip
8. Jet needle
9. Starter plunger
10. Throttle stop rod
11. Throttle slide
12. Needle jet
13. Float valve
14. Float
15. Float chamber
16. Main jet
17. Pilot jet
18. Idle air screw

CARBURETORS. Three Mikuni sliding valve carburetors are used on both models. Cable guides on carburetor tops should be adjusted so that all three throttle slides start to move at the same instant. Initial setting of pilot air screws (18—Fig. K6-1) is 1¼ turns out on 500cc models and 1½ turns out on 350cc and 750cc models. Adjust throttle stop screws (3) to provide the idle speed of 1500-1800 RPM. Check for equal backpressure from tail pipes on completion of carburetor adjustments. Refer to Fig. K6-1 and the following for H1 carburetor specifications:

Main jet (16) .....#100R
Needle jet (12) 0-2
Pilot jet (17) .....#30
Jet needle (8) .....5 GL 1

Clip (7) in third groove from top of needle (8). Float level on 500cc models should be 29-31 MM ($1\frac{5}{32}$-$1\frac{7}{32}$ inch) and on 350cc models should be 27-29 MM ($1\frac{1}{16}$-$1\frac{5}{32}$ inch). Float levels are adjusted by bending tang (B—Fig. K6-2)

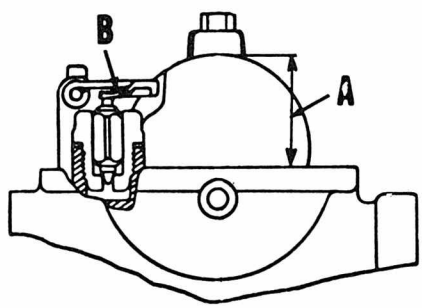


Fig. K6-2—Float level (A) may be adjusted by bending tang (B). Both sides of float should be of equal height.

The following standard jet sizes are used on 750cc models:

Main jet .....#105
Throttle valve 2.5
Jet needle .....5 FL 7
Needle jet 06/2
Pilot jet .....#35

Jet needle clip should be in second groove from top of needle.

IGNITION AND ELECTRICAL. The 12 volt system is equipped with a crankshaft mounted alternator and a frame mounted rectifier to convert AC to DC for all electrical operations.

Ignition Adjustment For S2 Models. A battery and coil ignition system with three sets of contract breaker points is used. Maximum point gap should be set at 0.012-0.016 inch. Ignition should occur (points just open) 23 degrees BTDC. Piston will be 0.102 inch BTDC at this time. Timing should be checked separately for each cylinder.

Ignition Adjustment For H1 Models. Ignition occurs at 25 degrees BTDC. Piston will be 0.136 inch BTDC at this time.

To check ignition timing, remove left spark plug and install a dial gage. Remove left side engine cover and turn crankshaft until piston is 0.136 inch (3.45 MM) BTDC. Mark (1—Fig. K6-3) should just align with raised mark (2) on signal pick up and pointer (4) should be aligned with another projection on signal generator rotor. Pointer may then be used for future reference. Timing may be adjusted by turning signal pick up base plate after loosening screws (3).

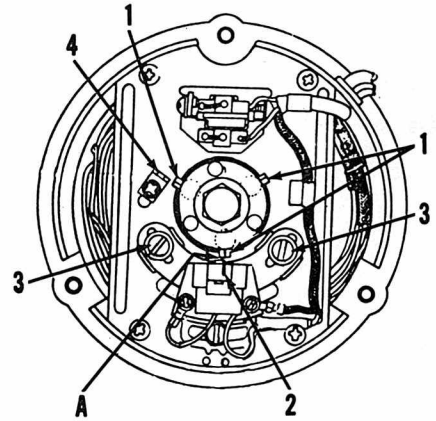


Fig. K6-3—Timing check and adjustment points for Mach III model. Air gap (A) should be from 0.008-0.016 inch.

1. Signal rotor pointers
2. Mark on pick up
3. Adjusting screws
4. Pointer

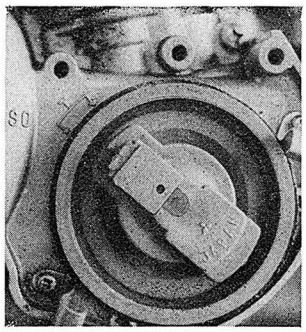


Fig. K6-4—Finger on distributor must be between marks on cover with RIGHT piston at TDC.

Air gap (A) between signal rotor and pick up should be 0.008-0.016 inch.

Distributor must be timed if right engine cover is removed. Place **right** piston in TDC position and align distributor rotor between two marks on right side cover (Fig. K6-4). Install right engine case. Timing is correct if rotor remains between two marks on case.

Explanation of Capacitor Discharge Ignition (CDI) System. Battery current (12 volts DC) is converted to 400 volts DC within the "B" unit (11—Fig. K6-6). The 400 volts is held in a capacitor until a trigger signal strikes the thyristor (SCR) and releases it to the high tension coil (8) for ignition. Ignition timing therefore, is the timing of the trigger signal. A signal generator rotor (1) is mounted on the left end of crankshaft and as it passes the signal pick up (3) it sets up a small current that is amplified and rectified to a sharp trigger signal for precise ignition timing. A distributor (on right side of engine) is placed in the system to direct this timed ignition pulse to the correct cylinder.

Trouble Shooting CDI System. This ignition system is extremely durable in normal operation but can be easily damaged by improper testing or servicing procedures. DO NOT disconnect battery terminals, even momentarily. DO NOT disconnect wires while engine is running, especially battery terminals. If connector plugs used to attach components become corroded, the effect can be the same as disconnecting the wire. Before servicing unit make certain that battery is fully charged, fuse is not blown and that connector plugs are making good contact.

If engine starts but does not run properly, first check condition of spark plugs and high tension wires. If one cylinder seems to be dead, check to see if all cylinders are firing using test plugs or similar equipment.

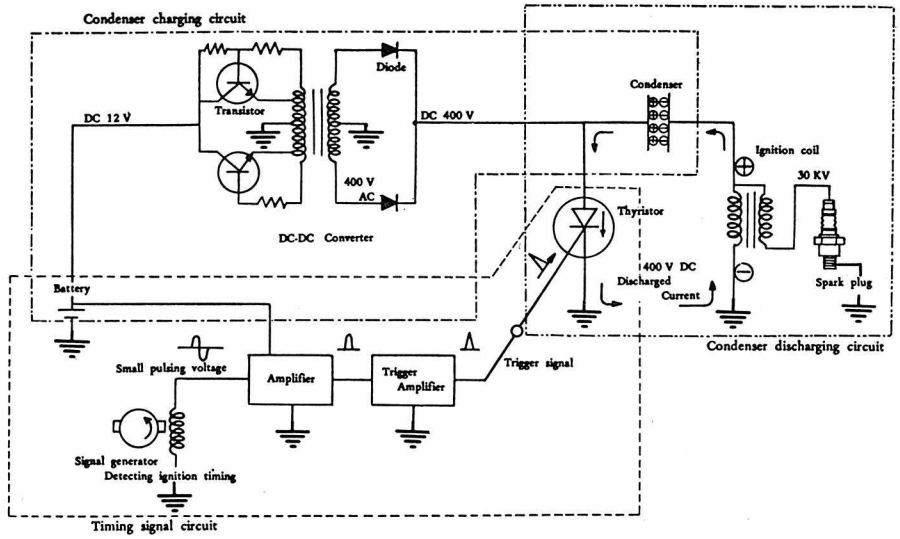


Fig. K6-5—Simplified diagram of Kawasaki Capacitor Discharge Ignition (CDI) system. Improper servicing may damage units, refer to text for proper procedure.

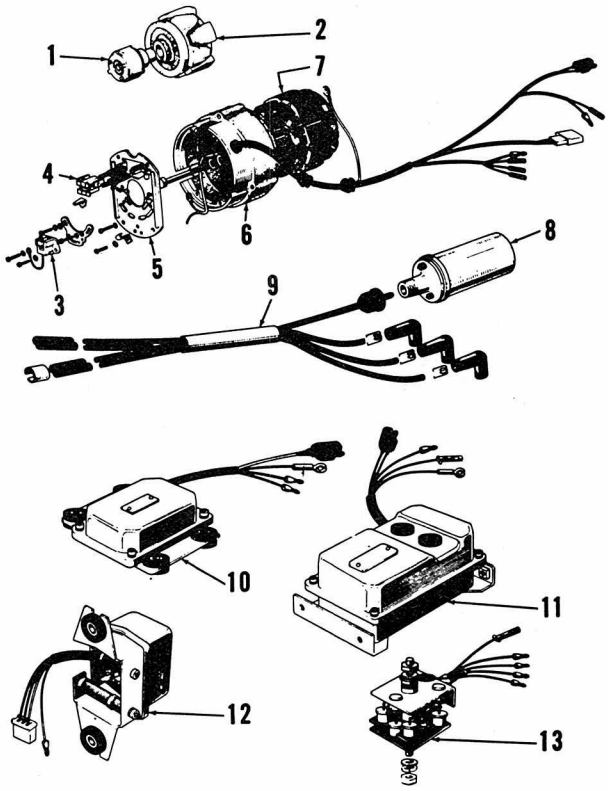


Fig. K6-6—Ignition and electrical system major parts.

1. Signal rotor
2. Alternator rotor
3. Signal pick up
4. Alternator brushes
5. Base plate
6. Yoke housing
7. Stator
8. High tension coil
9. High tension harness
10. "A" ignition unit
11. "B" ignition unit
12. Voltage regulator
13. Rectifier

If all cylinders are firing check ignition timing, trigger coil air gap and distributor rotor position as outlined in previous ignition adjustment paragraph. If condition still exists, make certain that problem is caused by faulty ignition, then check individual ignition components as described later. One cylinder not firing can only be caused by a malfunction between that cylinder and the distributor rotor.

If engine will not start, use the following procedure. Check battery voltage and make certain that fuse is not blown and connection is good. If battery voltage is not within range of 11-13 volts, check condition of charging system. Turn main switch ON and make certain that battery voltage is available to the ignition units. On both "A" and "B" unit, the brown wire should be positive and a black wire should be grounded to frame. If 11-13 volts is not available to the ignition units, check wires, connections and main switch for open circuit. The "B" unit (11—Fig. K6-6) is equipped with a transistor vibrator which should produce an audible sound when ignition (main) switch is ON. The sound should be extremely

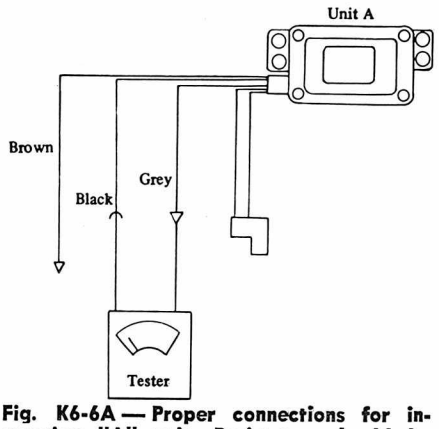


Fig. K6-6A — Proper connections for inspecting "A" unit. Resistance should be infinite in both directions.

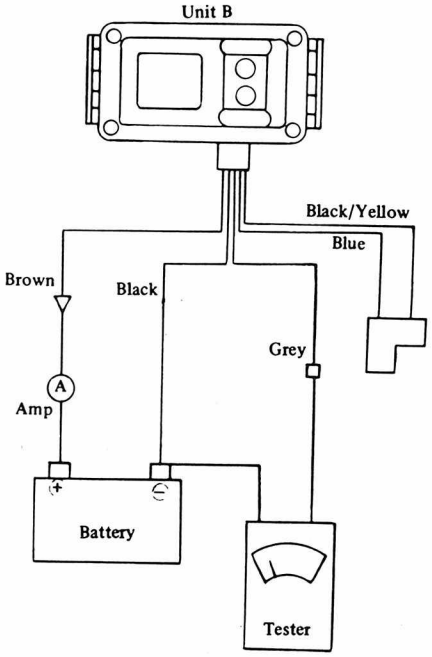


Fig. K6-6B — Proper connections for inspecting "B" unit. Unit should produce an audible buzz during the test.

steady (much like a tuning fork). Check for differences in sound with the gray wire (from "B" unit to "A" unit) disconnected and connected. If sound is different when gray wire is connected, renew "A" unit. If snapping sound (internal short) is heard from "B" unit, if "B" unit does not make any sound or if sound is irregular, renew "B" unit. Check resistance of signal pick up and high tension coil with an accurate ohmmeter. Resistance of signal pick up (3) should be 270-350 ohms. Resistance of primary winding in high tension coil (8) should be 3-4 ohms and secondary winding should have 6000-8000 ohms resistance.

The "A" unit (10—Fig. K6-6) can be checked separately as follows using an ohmmeter. Attach ohmmeter leads to gray wire and black (ground) wire as shown in Fig. K6-6A, then reverse ohmmeter leads and recheck.

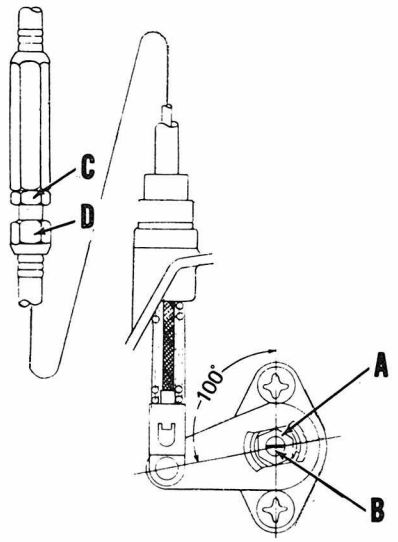


Fig. K6-7—Clutch adjustment on Kawasaki H1. Refer to text for procedure.

Resistance should be infinite with both connections.

The "B" unit (11—Fig. K6-6) can be checked separately as follows using an accurate ammeter and voltmeter. Connect a good, fully charged battery (12-12.5 volts) to "B" unit as shown in Fig. K6-6B, with ammeter (A—Amp) installed in positive lead. Connect voltmeter to battery ground and to gray wire. The ammeter should indicate 2-3 amps and should remain steady. Voltage indicated between gray wire and ground should be 350-450 volts. The "B" unit should make the tuning fork sound when checking. **CAUTION:** An open or a short in the high tension system (ignition coil, ignition leads, distributor cap, distributor rotor and spark plugs) can easily damage the system. Make certain that connections are secure and well insulated. Any high tension leads that have visible damage anywhere should be renewed. Do not use resistor type wire or resistor type spark plug caps. Use of a high quality ignition sealer is recommended at all high tension connections.

DO NOT attempt to work on the high tension system with the main switch on. Up to 30,000 volts are available to the circuit.

LUBRICATION. Gear box capacity is 1.7 qt. Fluid (SAE 30 motor oil) should be renewed every 2000 miles.

Engine lubrication is accomplished by an automatic oil metering system. Oil is pumped and metered to the intake passage and to the crankshaft main bearings on H1 models in an amount proportionate to the throttle opening. One way check valves are located in the oil pressure lines.

Oil used in the system should be type intended for use in air cooled

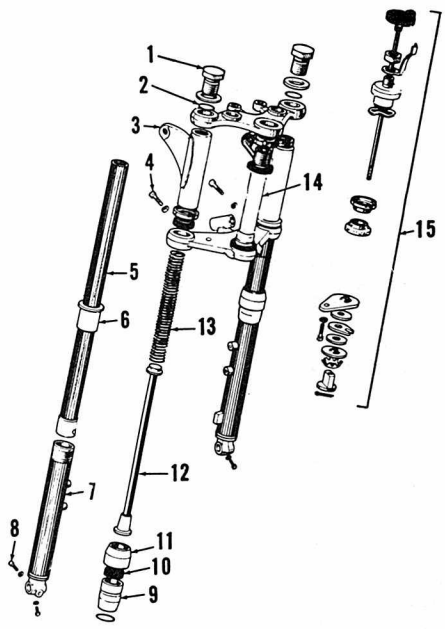


Fig. K6-8—Front suspension units used on Mach III.

1. Fork top bolt
2. "O" ring
3. Head light bracket
4. Fork pinch bolt
5. Fork inner tube
6. Metal slider
7. Fork outer tube
8. Oil drain screw
9. Outer tube nut
10. Oil seal
11. Dust cover
12. Spring guide
13. Inner fork spring
14. Steering stem
15. Steering damper assembly

two cycle engines only. Oil pump cable should be adjusted so that pump pulley just begins to move after throttle slides have moved 1/8-inch.

If pump has been removed or allowed to run dry, it must be bled. Loosen oil supply line banjo bolt at pump and allow oil to seep from bolt until air bubbles are no longer present. Hold pump pulley in the full on position and run engine at idle until air is no longer visible in oil delivery lines and heavy smoke is coming from exhaust.

CLUTCH CONTROLS. Remove drive sprocket cover and loosen lock nut (A—Fig. K6-7). Back adjusting screw (B) out until it is loose. Adjust cable at adjuster (D) until angle between clutch release arm and base plate is 100 degrees then tighten lock nut (C). Turn adjusting screw (B) in until a resistance is felt then tighten lock nut (A). Adjust cable at clutch lever on handle to obtain $\frac{5}{32}$ inch free play at pivot.

SUSPENSION. Oil used in front suspension units should be a mixture of 65% SAE 30 motor oil and 35% SAE 60 spindle oil. Each front suspension unit contains 230cc of this mixture. Standard free length of fork spring (13—Fig. K6-8) is 13.58 inches. Renew spring if less than 13.18 inches long. Oil may be drained from forks by removing screws (8). Forks may be disassembled by clamping the

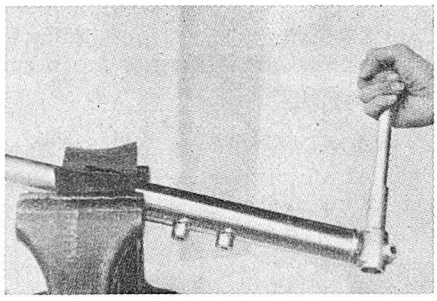


Fig. K6-9—Care should be taken to prevent damage to outer tube nut in vise.

outer tube nut (9) in a vise and turning the outer tube (7) as shown in Fig. K6-9.

Rear suspension units are adjustable to five different settings depending on rider preference. Units are not repairable and should be renewed if leaking or damaged.

REPAIRS

PISTONS, RINGS AND CYLINDERS. Cylinders and pistons may be removed without dismounting engine from frame. Refer to the following repair specifications:

Maximum cylinder taper or out of round .....0.0019 inch
Piston skirt to cylinder clearance (H1) .....0.0022 inch
(S2) .....0.0012 inch
Piston ring end gap
(H1) .....0.008-0.012 inch
(S2) .....0.006-0.014 inch

Pistons are installed with arrows on dome toward front (exhaust side) of engine. Chrome ring is used in top groove. Expander is used behind lower ring. Markings on rings go toward top. Piston is measured ⅛ inch from bottom at a right angle to pin hole for cylinder clearance check. Pistons and rings are available in standard size and two oversizes from the manufacturer. New piston pin retaining clips should be used on each assembly. Head retaining bolts should be torqued to 19 foot pounds using a cross pattern to prevent warpage.

CRANKSHAFT AND CRANKCASE. Crankcase halves are held together by studs. Cases may be separated without removing cylinders but cylinders must be removed if crankshaft is to be disturbed.

Maximum crankshaft runout is 0.0024 inch checked by supporting crankshaft on lathe centers and measuring at main bearings. Side clearance between large end of connecting rod and crank cheek should be 0.008-0.013 inch.

CLUTCH. The wet type multi-disc unit is operated by a series of push rods running through the transmission drive shaft. Clutch is disassembled by removing five bolts that secure clutch springs (20—Fig. K6-13) and removing pressure plate (18).

Standard free length of clutch springs is 1.40 inch. Springs shorter than 1.32 inch should be renewed. Standard thickness of friction disc is 0.11 inch. Discs thinner than 0.10 inch should be renewed. Friction discs should also be renewed if clearance between disc and clutch boss (Fig. K6-12) exceeds 0.002-0.012 inch.

TRANSMISSION. The five speed unit is removable after separating the cases. Inspect gears for wear and broken teeth. Inspect shift forks for evidence of damage. On reassembly, make certain that end of kickstart return spring is held in notch in upper crankcase half.

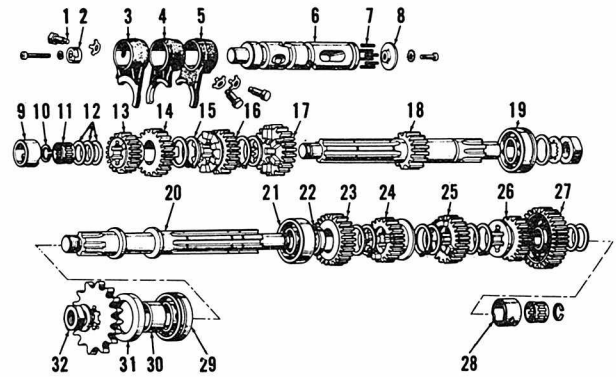


Fig. K6-11 — Exploded view of H1 transmission. Shift forks (3&4) may be interchanged.

1. Shift fork guide pin
2. Neutral switch rotor
3. Shift fork
4. Shift fork
5. Low gear shift fork
6. Shift drum
7. Locating pins
8. Drum pin plate
9. Bushing
10. Retaining clip
11. Caged needle bearing
12. Thrust washers
13. Second drive gear
14. Fourth drive gear
15. Snap ring
16. Third drive gear
17. Fifth drive gear
18. Drive shaft
19. Ball bearing
20. Output shaft
21. Ball bearing
22. Collar
23. Second output gear
24. Fourth output gear
25. Third output gear
26. Fifth output gear
27. First output gear
28. Bushing
29. Ball bearing
30. Sprocket spacer
31. Oil seal
32. Drive sprocket (14, 15 or 16 teeth)

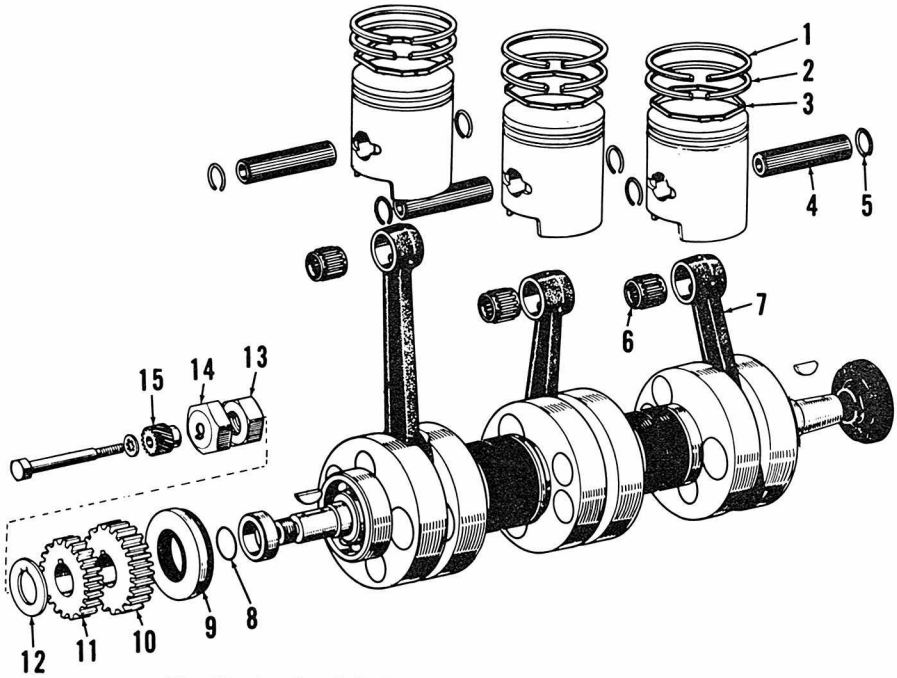


Fig. K6-10—Crankshaft and related parts of Kawasaki H1.

1. Chrome piston ring
2. Plain piston ring
3. Expander ring
4. Piston pin
5. Retaining clip
6. Caged needle bearing
7. Connecting rod
8. "O" ring
9. Oil seal
10. Primary gear
11. Distributor pinion
12. Lock washer
13. Primary gear retaining nut
14. Locking plate
15. Tachometer drive gear

SPEED TUNING

The H1R is the competition version of the 500cc Kawasaki H1 (Mach III). Some features of the H1R may be incorporated in standard H1 parts for an increase in performance. Any modification of parts will void the manufacturers warranty.

SPARK PLUGS AND IGNITION. The H1R uses a conventional contact breaker battery ignition with the tim-

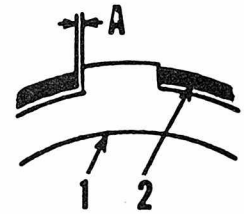


Fig. K6-12—Clearance (A) between clutch boss (1) and friction disc (2) should be 0.002-0.012 inch.

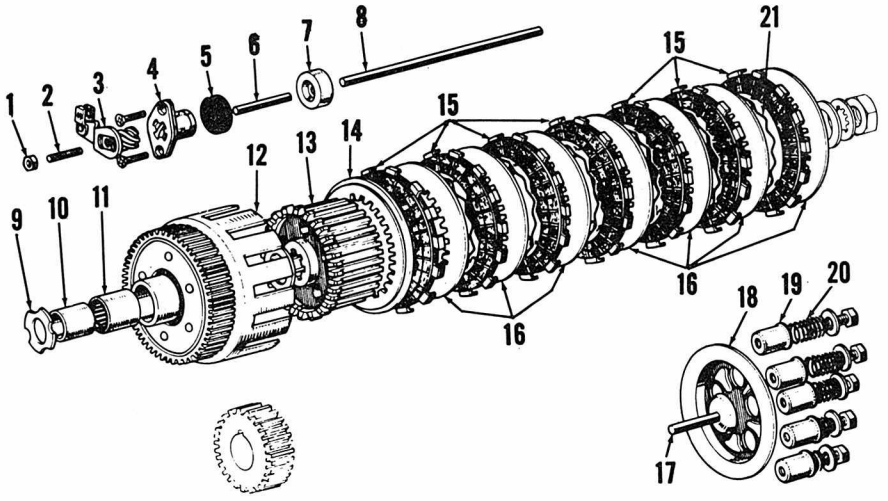


Fig. K6-13—Exploded view of clutch assembly used. Expander rings (21) are installed with friction discs (15) between steel plates (16).

1. Lock nut
2. Adjusting screw
3. Release arm
4. Base plate
5. Seal
6. Push rod
7. Bushing
8. Push rod
9. Thrust washer
10. Bushing
11. Needle bearing
12. Clutch boss
13. Clutch hub
14. Outer plate
15. Friction disc
16. Steel plate
17. Push rod
18. Pusher plate
19. Spring guide
20. Clutch spring
21. Expander ring

ing fixed at 25 degrees BTDC. Three sets of breaker points are used, thus eliminating the distributor found on standard models.

Recommended spark plug for the battery ignition system is NGK racing type B-10EN with an electrode gap of 0.018-0.020 inch.

CARBURETORS. Three Mikuni sliding valve 35 MM units are used on the H1R Road Racer.

LUBRICATION. H1R uses a 20:1 fuel and oil mixture in the fuel tank and an oil metering system to supply oil for crankshaft main bearing lubrication.

PISTON, CYLINDER AND HEAD. Compression ratio of the H1R is 7.5:1 compared to a 6.8:1 ratio of the standard H1. Piston is a special racing type with two 1 MM thick piston rings. Cylinders have larger ports than standard and are timed to the following specifications:

Intake open .....81 degrees BTDC (76 degrees Std.)
Transfer open .....63 degrees BBDC (59.5 degrees Std.)
Exhaust open .....97 degrees BBDC (89 degrees Std.)

CONNECTING RODS. Connecting rods on the H1R have been slotted at the crankshaft end to provide better lubrication.

LAMBRETTA

HAP JONES DIST. CO.
P. O. Box 3068—San Francisco, Calif. 94119

MODEL	Cento	125 li	150 li & 150 Spl.	175 tv	200 tv
Displacement-cc	98	123	148	175	198
Bore-MM	51	52	57	62	66
Stroke-MM	48	58	58	58	58
Number of cylinders	1	1	1	1	1
Oil-fuel ratio	1 to 50				1 to 25
Plug gap-inch	0.020-0.025	0.020-0.025	0.020-0.025	0.020-0.025	0.020-0.025
Point gap-inch	0.014-0.018	0.014-0.018	0.014-0.018	0.014-0.018	0.014-0.018
Ignition timing	fixed	fixed	fixed	fixed	fixed
Degrees BTDC	23	23	23	23	23
Electrical system voltage	6	6	6	6	6
Battery terminal grounded	NA	Neg.	Neg.	Neg.	Neg.
Tire size-front	3.00 X 10	3.50 X 10	3.50 X 10	3.50 X 10	3.50 X 10
Rear	3.00 X 10	3.50 X 10	3.50 X 10	3.50 X 10	3.50 X 10
Tire pressure psi-front*	18.5	12	12	12	12
Rear*	28.5	18	18	18	18
Number of speeds	3	4	4	4	4
Weight-lbs. (approx.)	176	230	231	242	242

*Pressures given for driver only. On Cento with passenger, 20 front, 35.5 rear. On all other models with passenger, 32 rear.

MAINTENANCE

SPARK PLUG. A 14 MM ¾-inch reach spark plug such as Marelli CW225G is used for 125 li, 125 li II, 150 li, 150 li II and 175 tv II. U. S. replacement is Champion N-84. An 18MM spark plug such as Bosch M225 or M240T1 is used on 125 li III, 150 li III, 150 Special, 175 tv III, 200 tv and Cento models. Electrode gap is 0.5-0.6 MM (0.020-0.025 in.) for all models.

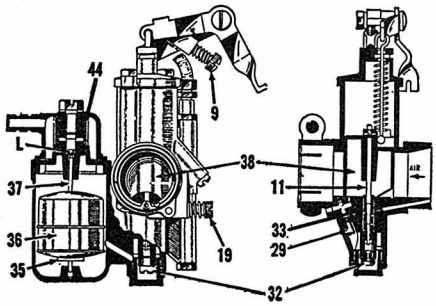


Fig. LM1-1—Cross sectional view of typical Del' Orto MA and MB type carburetor. Idle mixture adjustment is accomplished by turning screw (19). Refer to Fig. LM1-2 for legend.

CARBURETOR. Italian Del 'Orto carburetors are used on all models. Specific carburetor usage is as follows.

ENGINE MODEL	Carburetor Number
125 li	MA 18 Bs 5
125 li II	MA 18 Bs 5 and MA 18 Bs 7
150 li	MA 19 Bs 5
150 li II	MA 19 Bs 5 and MA 19 Bs 7
175 tv II	MB 21, MB 21 Bs 7 & MB 23 Bs 5
Cento	SHB 18
125 li III	SH 1/18
150 li III	SH 1/18
150 Special	SH 18
175 tv-III	SH 1/20
200 tv	SH 20

MA & MB CARBURETORS. Figs. LM1-1 and LM1-2 show typical MA and MB carburetors. Idle mixture is adjusted by turning screw (19). The upper end of needle (11) is provided with three grooves. Clip (13—Fig. LM1-2) is positioned in one of these three grooves. Under normal conditions, the center groove should be used and will generally provide the correct intermediate speed mixture. Installation of clip in higher groove will lean the mixture.

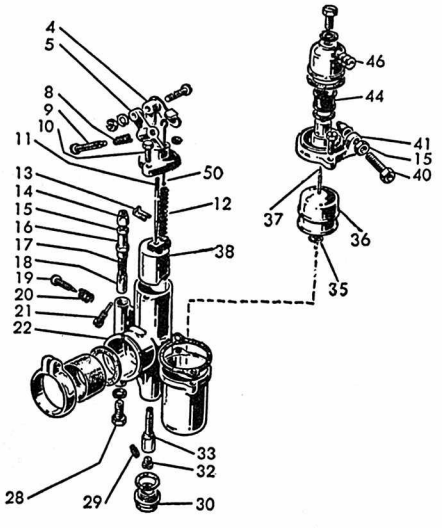


Fig. LM1-2—Exploded view of typical Del' Orto MA and MB type carburetor.

4. Bellcrank
5. Cover
9. Idle speed adj. screw
11. Jet needle
12. Air slide spring
13. Retaining clip
14. Cable adjuster
18. Starting valve
19. Idle mixture adj. screw
20. Spring
21. Guide screw
28. Starter jet
29. Minimum (pilot) jet
32. Main jet
33. Atomizer
35. Retainer
36. Float
37. Needle
38. Throttle slide
40. Cable adjuster
44. Filter
50. Operating rod

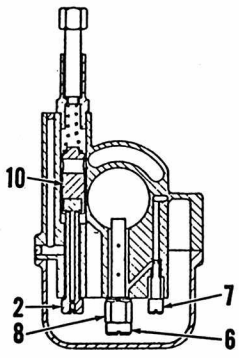


Fig. LM1-3 — Cross sectional view of typical Del' Orto SH type carburetor. Model SHB carburetor used on Cento is similar; however, it is not provided with pilot jet (7) and atomizer (8). Refer to Fig. LM1-4 for legend.

Refer to the following specifications and Fig. LM1-2.

MA 18 Bs 5 & MA 18 Bs 7

Main jet (32)	75
Starter jet (28)	55
Pilot jet (29)	35
Atomizer (33)	260B

MA 19 Bs 5 & MA 19 Bs 7

Main jet (32)	78
Starter jet (28)	55
Pilot jet (29)	40
Atomizer (33)	260B

MB 23 Bs 5

Main jet (32)	110
Starter jet (28)	60
Pilot jet (29)	40
Atomizer (33)	230B

MB 21 Bs 5 & MB 21 Bs 7

Main jet (32)	88
Starter jet (28)	60
Pilot jet (29)	40
Atomizer (33)	260B

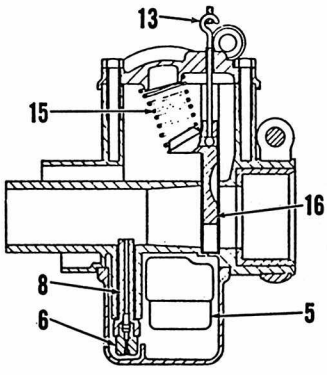
SH TYPE CARBURETORS. Figs. LM1-3 and LM 1-4 show typical SH carburetor. Idle mixture is adjusted by turning screw (9). Normal setting is 1-1½ turns open. Idle speed is adjusted at screw (14). Refer to the following specifications and Fig. LM1-4.

SH 1/18 (125 li III)

Main jet (6)	99
Starter jet (2)	42
Pilot jet (7)	50
Atomizer (8)	1.5 MM

SH 1/18 (150 li III)

Main jet (6)	105
Starter jet (2)	45
Pilot jet (7)	50
Atomizer (8)	1.5 MM



SH 18

Main jet (6)	101
Starter jet (2)	45
Pilot jet (7)	50
Atomizer (8)	1.75 MM

SH 1/20

Main jet (6)	106
Starter jet (2)	50
Pilot jet (7)	50
Atomizer (8)	1.75 MM

SH 20

Main jet (6)	108
Starter jet (2)	50
Pilot jet (7)	48
Atomizer (8)	1.75 MM

IGNITION AND ELECTRICAL. A flywheel type magneto is used with the high tension ignition coil mounted outside the flywheeel. Breaker con-

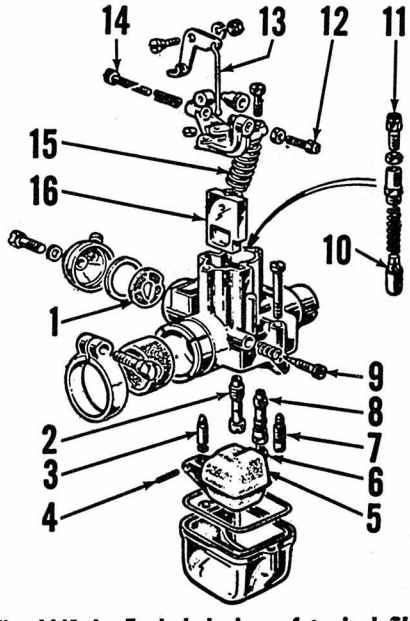


Fig. LM1-4—Exploded view of typical SH carburetor. Model SHB used on Cento is not provided with pilot jet (7) and atomizer (8).

1. Fuel filter
2. Starter jet
3. Fuel inlet needle
4. Float pivot
5. Float
6. Main jet
7. Pilot jet
8. Atomizer
9. Idle mixture needle
10. Starter valve
11. Cable adjuster
12. Cable adjuster
13. Throttle rod
14. Idle speed screw
15. Throttle valve spring
16. Throttle valve

tact gap should be 0.35-0.45 MM (0.014-0.018 in.). Adjustment of point gap can be made through ports in flywheel without removing the flywheel.

Ignition timing (points just beginning to open) should occur 23 degrees BTDC. Timing can be varied after removing the flywheel, by shifting the stator plate.

LUBRICATION. Engine lubrication is obtained by mixing SAE 30 two stroke oil with the fuel. Normal ratio is 1:50 for Cento, 125 li III, 150 li III and 150 Special. Ratio should be 1:25 for all other models. The gear box should be drained and refilled with SAE 90 oil every 2,500 miles.

CLUTCH CONTROL. The clutch hand lever should have 1-2 MM (0.04-0.08 in.) free play as shown in Fig. LM1-5. Adjustment is accomplished at adjuster (2—Fig. LM1-6) after lock nut (1) is loosened. Make certain clutch completely disengages when lever is completely compressed.

PRIMARY CHAIN. The distance between the crankcase cover gasket surface on the crankcase and the face of the drive sprocket (82—Fig. LM1-8) should be the same as the distance from crankcase gasket surface and face of rear sprocket. (Lambretta tool No. 59084 or equivalent and a dial indicator can be used to check distance.) If face of rear sprocket protrudes more than 0.002 inch (0.05 MM) more than face of drive sprocket, reduce the thickness of shims (49); if face of rear sprocket is more than 0.010 inch (0.25 MM) farther in than face of drive sprocket, increase thickness of shims (49).

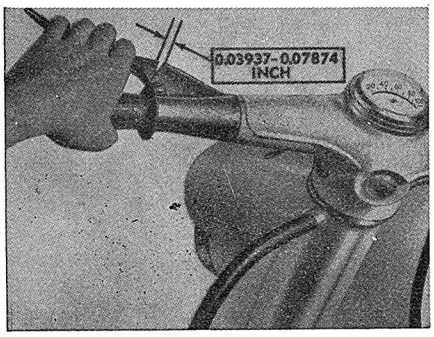


Fig. LM1-5—Clutch hand lever should have 1-2MM free play as shown.

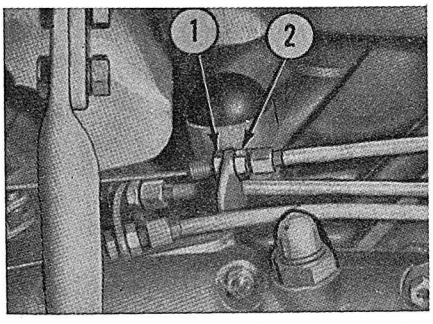


Fig. LM1-6—Clutch is adjusted by turning nuts (1 & 2) until free play at hand control lever is as shown in Fig. LM1-5. Late models are similar.

REPAIRS

Because of the close tolerance of the interior parts, cleanliness is of the utmost importance. It is suggested that the exterior of the engine, gear box and all nearby areas be absolutely clean before any repair is started.

Major overhaul work should not be done without using special Lambretta tools or equivalent.

PISTON, RINGS AND CYLINDER. Pistons and cylinders are supplied in three standard gradings, plus, zero and minus and are marked with a "+", "0" or "—" on crown of piston and on top of cylinder. Pistons and cylinders marked "—" range from 0 to .006 MM (0 to .00024 inch) over nominal size; those marked "0" range from .007 to .013 MM (.00028 to .00052 inch) over nominal size; and those marked "+" range from .014 to .020 MM (.00057 to .00081 inch) over nominal size.

Pistons of 0.2, 0.4 and 0.6 MM oversizes are available. Oversize pistons also come in three grades (minus, zero and plus). When fitting oversized pistons, first bore cylinder to 0.00197-0.00276 inch (0.05-0.07 MM) less than desired oversize; then, hone to correct size using No. 180 abrasive.

Desired clearance between piston skirt and cylinder wall is .034 to .046 MM (.00134 to .00181 inch) for 125 li. engine; .038 to .050 MM (.00150 to .00197 inch) on 150 li. engine; and .044 to .056 MM (.00173 to .00220 inch) on 175 tv and 200 tv; on either standard or oversize pistons and cylinders. Maximum wear limit clearance between piston skirt and cylinder wall is .15 MM (.0059 inch) on all engines. Clearance is measured at right angle to piston pin. Piston ring positioning pins should be toward inlet side and arrow on piston crown should face toward exhaust port. Refer to the following specifications.

Ring end gap .....0.20-0.35 MM
0.008-0.014 in.
wear limit .....0.60 MM
0.024 in.

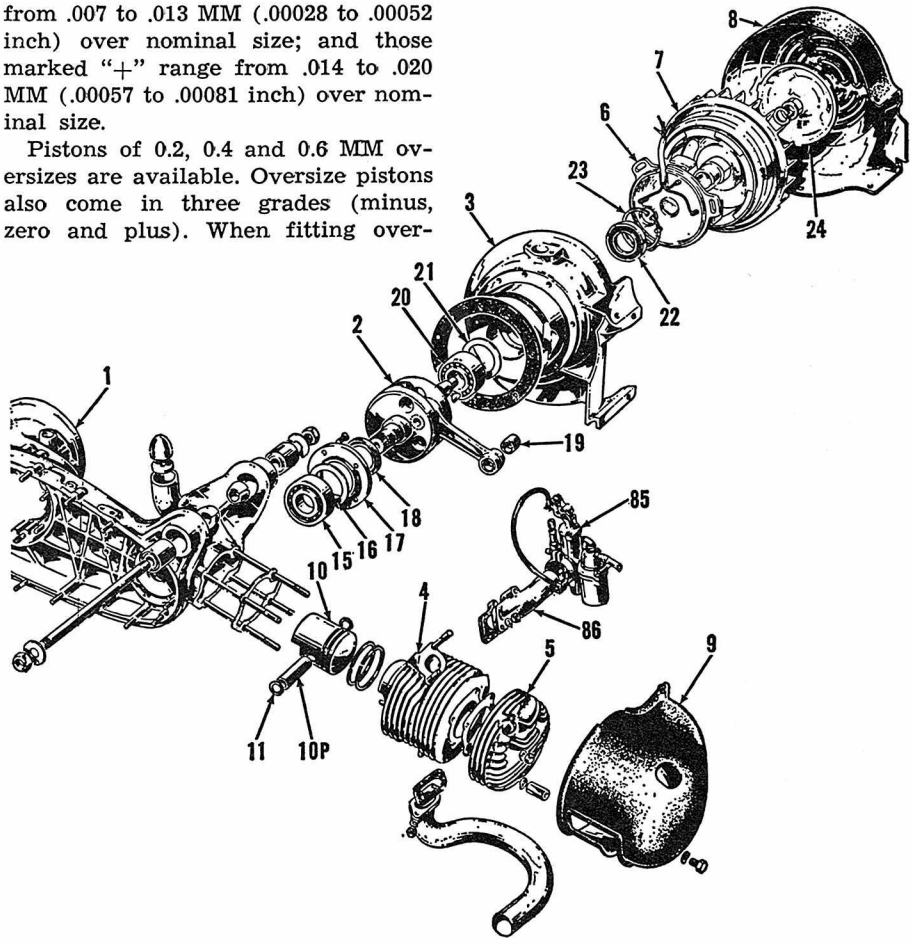


Fig. LM1-7—Exploded view of the engine assembly. The crankshaft and rod units are available only as an assembly (2). An early model is shown.

1. Crankcase
2. Crankshaft and rod
3. Flywheel support flange
4. Cylinder
5. Cylinder head
6. Magneto stator plate
7. Flywheel
8. Flywheel cowl
9. Cylinder cowl
10. Piston
10P. Piston pin
11. Snap rings
15. Ball bearing
16. Thrust washer
17. Bearing retainer
18. Oil seal
19. Bushing or bearing
21. Thrust washer
22. Oil seal
23. Snap ring
24. Dust cover
85. Carburetor
86. Inlet manifold

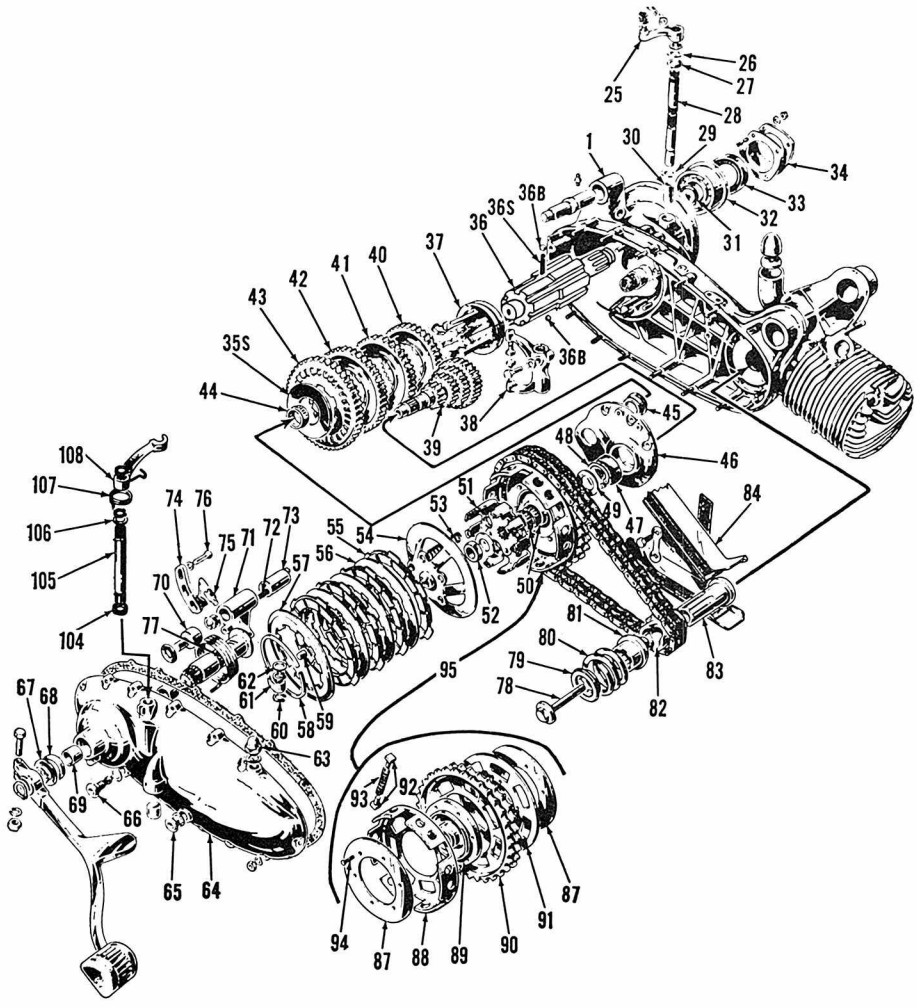


Fig. LM1-8—Exploded view of crankcase, clutch and gears. The clutch outer bell housing, sprocket and torque damper unit (95) is also shown exploded (parts 87 through 94). An early model is shown.

1. Crankcase
25. Gear shift lever
26. Spacer washer
27. Gasket
28. Gear shift shaft
29. Spacer washer
30. Bushing
31. Seal
32. Bearing
33. Seal
34. Bearing retainer
35S. Shim
36. Lay shaft
36B. Gear selector detent balls (2 used)
36S. Spring
37. Gear selector sleeve
38. Gear change fork
39. Main (cluster) gear
40. Fourth gear
41. Third gear
42. Second gear
43. First gear
44. Needle bearing
45. Outer race
46. Support flange
47. Ball bearing
48. Snap ring
49. Shim (0.8, 1.0,1.2, 1.4 and 1.6 MM)
50. Needle bearings
51. Inner bell
52. Nut
53. Spring (5 used)
54. Flange
55. Driving discs (4 used)
56. Driven discs (3 used)
57. External disc
58. Snap ring
59. Push rod
60. Snap rings
61. Clutch release lever (cam)
62. Shim
63. Oil filler plug
64. Crankcase cover
65. Oil level plug
66. Oil drain plug
67. Shim
68. Oil seal
69. Bushing
70. Stop screw
71. Kick start shaft
72. Spring
73. Piston (engaging claw)
74. Cam
75. Follower pin
76. Cam retaining screws (3 used)
77. Return spring
78. Cap screw
79. Washer
80. Spring
81. Collar (dog)
82. Sprocket
83. Adaptor
84. Chain guide
87. Torque damper driven discs
88. Outer bell housing
89. Hub
90. Sprocket
91. Sprocket holding disc
92. End caps (14 used)
93. Torque damper springs (7 used)
94. Rivets (7 used)
95. Torque damper-sprocket unit

Piston pin to piston
wear limit .....0.010 MM
0.0039 in.

Ring groove clearance
wear limit .....0.20 MM
0.008 in.

Pin - rod bushing ....0.024-0.035 MM
0.0009-0.0014 in.
wear limit .....0.050 MM
0.0020 in.

Standard bore diameter —
Cento .....51.0 MM
2.00787 in.
125 li .....52.0 MM
2.04724 in.
150 li & 150 Spl. .....57.0 MM
2.24409 in.
175 tv .....62.0 MM
2.44094 in.
200 tv .....66.0 MM
2.59842 in.

CONNECTING ROD AND CRANKSHAFT. To remove the connecting rod, crankshaft and weights assembly, first remove the cylinder head and cylinder. Drain oil from gear box, disconnect rear of clutch release cable from external clutch release lever

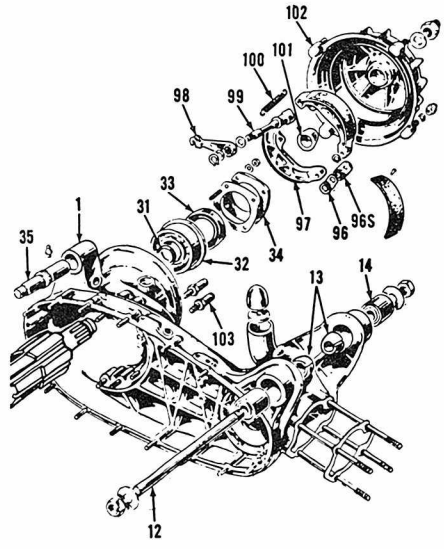


Fig. LM1-9—Exploded view of the rear brake assembly and engine front pivot mount.

1. Crankcase
12. Pivot stud
13. Locking cones
14. Motor mount blocks
31. Seal
32. Bearing
33. Seal
34. Bearing retainer
35. Rear suspension shaft
96. Connecting plate
96S. Spring plate
97. Brake shoes
98. Brake control lever
99. Brake shaft and cam
100. Return spring
101. Hub cone
102. Drum (wheel hub)
103. Brake shoe anchor pins

(108—Fig. LM1-8), then unbolt and remove crankcase cover retaining nuts and lift cover (64) off. Compress clutch using Lambretta tool No. 59351 or equivalent and remove retaining ring (58). Withdraw clutch parts (53, 54, 55, 56 & 57). Remove nut (52) and using a suitable puller (such as Lambretta No. 59328) withdraw clutch internal bell (51). Remove the clutch outer bell housing (torque damper) assembly (95). NOTE: Take care not to lose or damage shim or shims (49) as chain alignment will be affected. Remove the two cap screws attaching chain guide (84) to crankcase, then remove chain and guide. Remove piston pin retaining ring (11—Fig. LM1-7), piston pin (10P) and piston (10). Remove fan cover (8), dust cover (24), flywheeel (7) and stator plate (6). Using a suitable puller (Lambretta No. 58903 or equivalent) remove the flywheel support flange (3). Remove cap screw (78—Fig. LM1-8) and withdraw washer (79), spring (80), splined collar (81), sprocket (82) and adaptor (83). The crankshaft and rod unit (2—Fig. LM1-7) can now be removed by bumping shaft out of bearing (15).

The flywheel flange (3) should be heated before crankshaft roller bearing (20) outer race is removed or reinstalled.

The connecting rod and crankshaft unit should be renewed if rod side play is more than 0.016 inch (0.40 MM), as individual parts are not catalogued.

When reassembling, reverse the removal procedure.

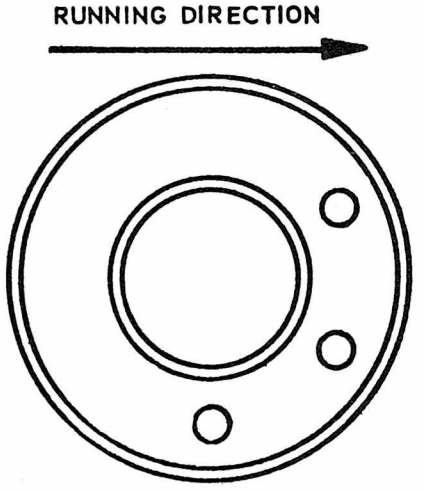


Fig. LM1-10—Motor mount blocks (14-Fig. LM1-9) on late models, are provided with three dampening holes as shown. Blocks should be assembled with one hole directly at the bottom and others toward front.

GEAR BOX. The transmission used in Cento model is three speed, all others are four speeds. Basic information is similar. Refer to Fig. LM1-11 for exploded view of Cento Unit.

To remove gears and shafts from the gear box, remove the rear wheel and brake drum and proceed as follows: Drain oil from gear compartment and disconnect rear of clutch release cable from lever (108—Fig. LM1-8). Unbolt and remove cover (64). Compress clutch using Lambretta tool No. 59351 or equivalent and remove snap ring (58) and lift parts (53, 54, 55, 56 & 57) off. Remove nut (52) and use a puller such as Lambretta No. 59328 to remove inner bell (51); then, lift outer bell housing, sprocket and torque damper (95) off. NOTE: Take care not to lose or damage shim or shims (49). Remove the two screws which attach chain guide (84) to crankcase, then remove chain and guide. Unbolt and remove support flange (46). NOTE: The flange is provided with two threaded holes into which screws can be fitted to push flange away from the case. Withdraw main (cluster) shaft (39) and lay shaft gears (40, 41, 42 & 43) and shim (35S). NOTE: Take care not to damage or lose shim or shims (35S).

To remove the lay shaft, remove snap ring from gear change shaft (28) and withdraw shaft. Remove nut from end of lay shaft and using a suitable puller remove rear brake drum. Remove bearing retainer (34) and bump shaft out of bearing (32). Take care not to lose detent balls (36B) when removing selector (37).

When reassembling, reverse the disassembly procedure. When installing lay shaft, first fit detent ball (36B), spring (36S) and selector sleeve (37) on shaft. Lay shaft gears should be installed as follows: Fourth speed gear (40), high part of boss facing crankcase cover (right side); third speed gear (41), high part of boss facing wheel (left side); second speed gear (42), high part of boss facing wheel (left side); first speed gear (43), kick starter teeth on side of gear toward crankcase cover (right side).

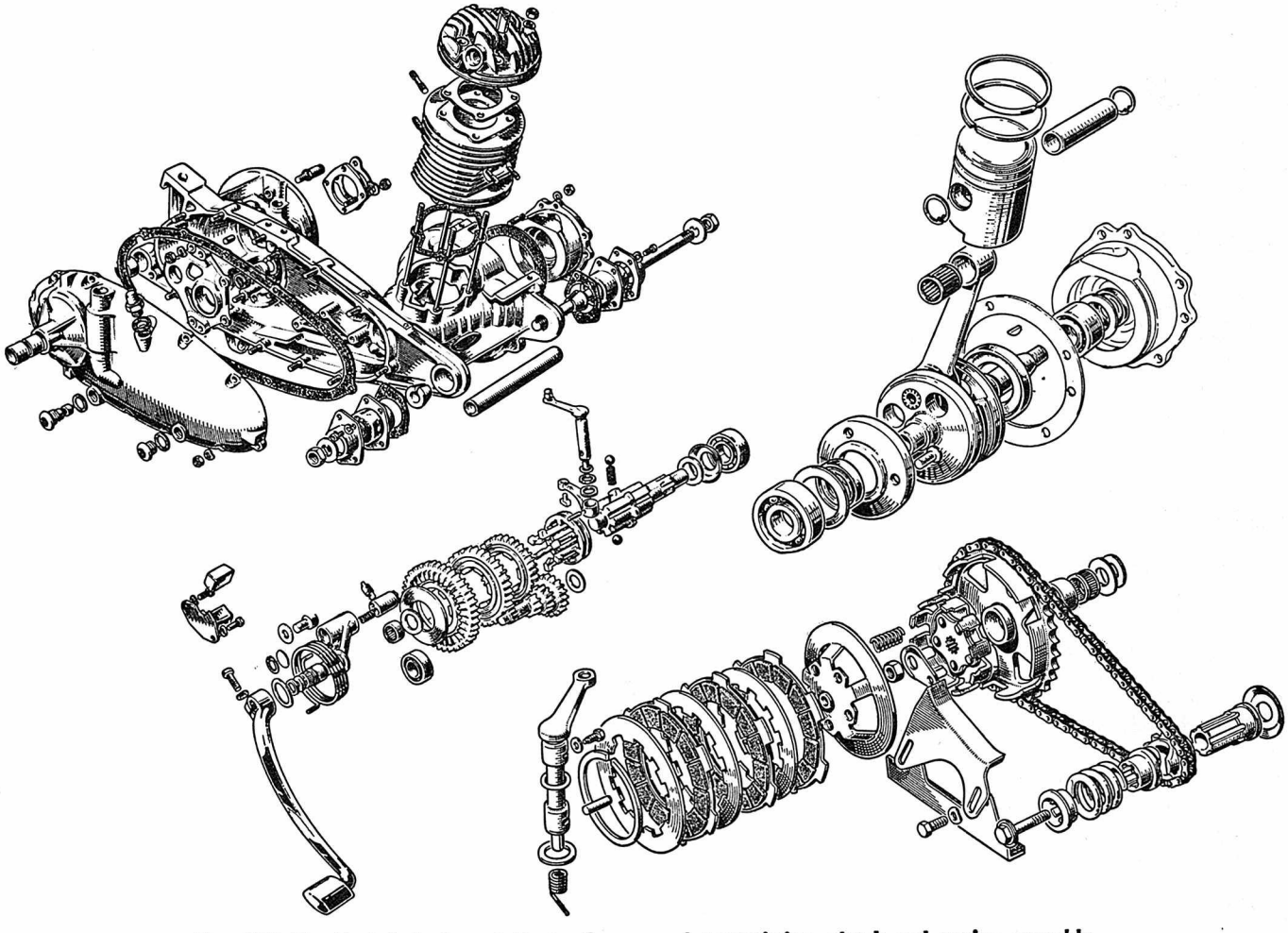


Fig. LM1-11—Exploded view of Cento three speed transmission, clutch and engine assembly.

MAICO

COOPER MOTORS
110 E. Santa Anita
Burbank, Calif. 91502

MOTO CROSS MODELS

MODEL	250	360	400	501
Displacement—cc	250	354	400	501
Bore—MM	67	77	77	91.6
Stroke—MM	70	76	83	76
Number of cylinders	1	1	1	1
Oil-Fuel ratio	1:20	1:20	1:20	1:20
Plug gap—inch	0.018-0.020*			
Point gap—inch	0.012-0.016			
Ignition timing	Fixed			
Piston position BTDC—Inch	0.106-0.114	0.137-0.149	0.149-0.157	0.137-0.149
Tire size—Front	3.00x21			
Rear	4.00x18	4.00x18	4.00x18	4.50x18
Tire pressure—Front	15 PSI**			
Tire pressure—Rear	13 PSI**			
Rear chain free play inch	See Fig. MA4			
Number of speeds	4			
Weight—Lbs. (approx.)	220	220	230	239

*Electrode gap should be 0.022-0.024 when using Champion Gold Palladium plugs.
**When racing in mud use 10 PSI in front tire and 8 PSI in rear tire.

MAINTENANCE

SPARK PLUG AND IGNITION. Both Bosch and Champion plugs are recommended by Maico. K-501 models require a Bosch type W310T17 in center hole and a W340T17 in side plug hole. All other models use W310T16 Bosch plugs in center plug hole and W340T16 plugs in side hole. Bosch plugs should have electrode gap set at 0.018-0.020 inch. Champion plugs should be gapped to 0.022-0.024 inch. K-501 models require two Champion N-2G plugs and all others use two L-2G Gold Palladium spark plugs.

A flywheel magneto is used to produce current for ignition on all models. The primary and secondary coils are both mounted in the magneto at the right end of crankshaft. Maximum gap of ignition points should be set at 0.012-0.016 inch. Ignition should occur (points just open) as scribe mark on rotor (TM—Fig. MA1) is centered in ¾ inch hole in stator. Refer to the following chart for piston position on various models at this point:

250 cc..0.106-0.114 inch (2.7-2.9 MM) BTDC
360 cc..0.137-0.149 inch (3.5-3.8 MM) BTDC
400 cc..0.149-0.157 inch (3.8-4.0 MM) BTDC
501 cc..0.137-0.149 inch (3.5-3.8 MM) BTDC

Magneto rotor retaining bolt should be torqued to 6-8 foot pounds.

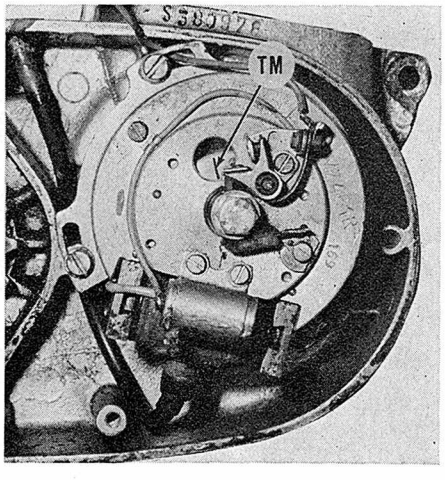


Fig. MA1—Timing mark (TM) will be centered in hole at correct position for ignition.

CARBURETOR. Standard carburetor for all models is a 36 MM Concentric. Either an Amal or a Bing unit may be used. Due to the various factors governing the operation of a high performance engine, no standard jet specifications are listed. The following sizes were used on some 250, 400 and 501 models and may be used as a starting point. Final selection of jet sizes should depend on track conditions at time of event. (See Fig. MA 2.)

250 Moto-Cross
Main jet (16) .....#180
Pilot jet (13) .....#40
Needle jet (14) .....#280
Throttle slide (8) .....#1
Clip (5) in second groove from top of needle (6).

400 Moto-Cross
Main jet (16) .....#185

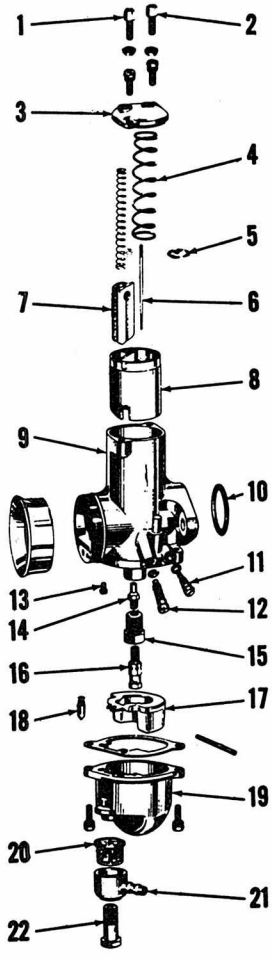


Fig. MA2—Exploded view of carburetor typical of original equipment on all models.

1. Choke cable adjuster
2. Throttle cable adjuster
3. Mixing chamber top
4. Throttle return spring
5. Jet needle clip
6. Jet needle
7. Choke plate
8. Throttle slide
9. Mixing chamber body
10. "O" ring
11. Pilot air screw
12. Throttle adjusting screw
13. Pilot jet
14. Needle jet
15. Jet holder
16. Main jet
17. Float
18. Fuel valve
19. Float chamber
20. Fuel filter
21. Fuel inlet pipe
22. Banjo bolt

Pilot jet (13) .....#40
Needle jet (14) .....#285
Throttle slide (8) .....#1
Clip (5) in second groove from top of needle (6).

501 Moto-Cross
Main jet (16) .....#185
Pilot jet (13) .....#35
Needle jet (14) .....#290
Throttle slide (8) .....#1
Clip (5) in second groove from top of needle (6)

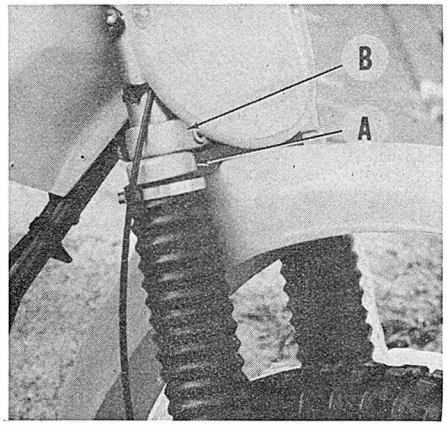


Fig. MA3—Front fork springs should be renewed if fork spring guide (A) falls away from triple clamp (B) when front of motorcycle is lifted.

LUBRICATION. Gearboxes on all models contain 1.05 qt. of lubricant. Units with large clutch (late 400 and 501 models) should be serviced with SAE 90 gear lube and units with small clutch (250, 360 and early 400 models) should be serviced with SAE 40 motor oil.

Engine lubrication is accomplished by mixing two cycle engine oil with the fuel in a 20:1 fuel to oil ratio. Maico **does not** recommend the use of concentrated lubricants that recommend 25:1, 32:1 or 40:1 mixtures.

SUSPENSION. Front suspension units should be drained and flushed with solvent after every four races. Fork assemblies contain approximately 200-250 cc of oil each. Viscosity of oil used will vary with rider preference but will usually be from SAE 10 to SAE 40 motor oil. Renew front fork inner springs if top fork spring guide (A—Fig. MA3) falls away from bottom triple clamp (B) when front of motorcycle is lifted.

Rear suspension units should be checked periodically for leakage or lack of dampening. Renew worn or damaged units.

REPAIRS

PISTON, RINGS AND CYLINDER. Cylinder and piston may be removed with engine in frame. After removing cylinder head it is necessary to remove cylinder hold down studs and move piston to Bottom Dead Center before cylinder may be lifted free of engine. Refer to the following repair specifications:

Piston skirt to cylinder
clearance (Standard) ....0.002 inch
(Limit) .....0.006 inch
Ring end gap (Standard) ..0.010 inch
Ring end gap (Limit) .....0.016 inch

Measure piston at bottom of skirt at a right angle to pin hole for cylinder clearance check. Piston should be installed with ring locating pins toward rear (intake side) of engine. Piston pin retaining clips should be renewed at each reassembly of piston and connecting rod. Open end of retaining clip should be toward top (Fig. MA5).

If a new piston is installed, allow approximately 75-100 miles to wear in new piston before racing. If a replacement cylinder liner is to be fitted, it should be turned down to obtain a 0.004-0.006 inch interference fit. Interference fit of a new cylinder and liner assembly is 0.013 inch. Cylinder head retaining nuts should be torqued to 12-15 foot pounds.

CRANKSHAFT AND CONNECTING ROD. Engine must be dismounted from frame and crankcase halves separated to remove crankshaft assembly. Maximum eccentricity of crankshaft is 0.002 inch measured at extreme end of magneto taper with crankshaft supported on a knife edge stand. Side clearance of connecting rod large end should be 0.019-0.020 inch. Crankshaft should be rebuilt if clearance is greater than 0.024 inch. Needle bearing in small end of connecting rod should be renewed after 8-10 races.

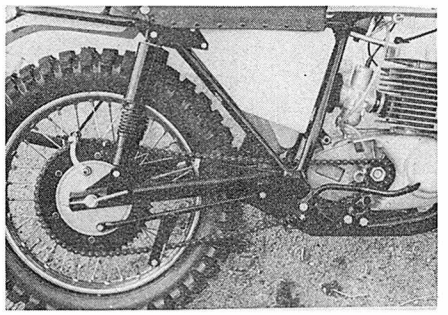


Fig. MA4 — Drive chain should be adjusted so that it nearly touches swing arm cross member.

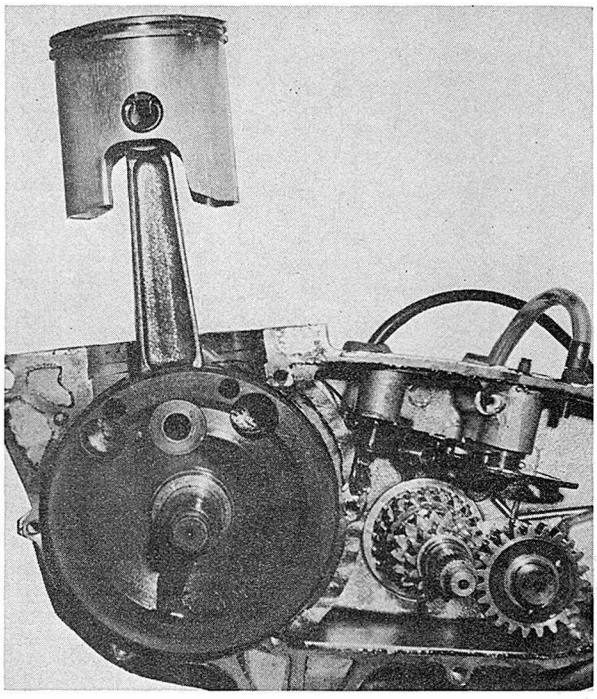


Fig. MA5—Maico engine ready for installation of left crankcase half.

CLUTCH. Clutch may be removed with engine in frame but Maico recommends laying motorcycle on its right side to aid in installing clutch springs. A three prong gear puller is recommended to prevent possible fracture of clutch hub. Use puller to compress clutch springs and then remove the two snap rings that secure the clutch plates to clutch center piece (A—Fig. MA6). Note stacking order of clutch plates when disassembling.

Fiber friction plate used on 250, 360 and early 400 cc models is 0.150 inch thick when new. Plate should be renewed if less than 0.145 inch thick. Standard thickness of driven plates is 0.050 inch and they should be renewed if worn thinner than 0.045 inch. The perforated driving plates used in late 400 and 501 cc models are 0.085 inch thick when new and

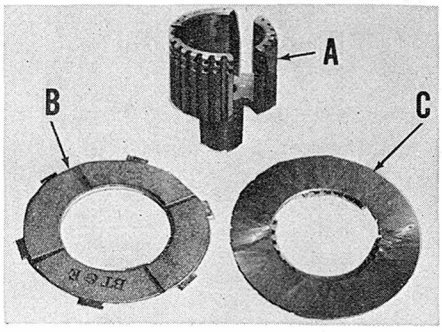


Fig. MA6—Snap rings on clutch center piece (A) are used to secure clutch plates (B&C). Fiber clutch disc (B) is used in 250, 360 and early 400cc models only.

A.)) (( )) (( )) (( )) (( ))

B. (( )) (( )) (( )) (( )) (( ))

C. () () () () () () () () () ()

Fig. MA7—Maico dished clutch springs should be stacked as shown. Refer to text for particular model.

should be renewed if less than 0.080 inch thick. Standard clutch spring height is 0.075 inch. Springs should be renewed if less than 0.070 inch high. Clutch springs should be stacked as in (A—Fig. MA7) on 250, 360 and early (fiber clutch plates) 400 cc models. Two extra models. Two extra springs may be added as in (B) if slippage is evident. All steel clutch used on late 400 cc and 501 cc models requires 18 springs arranged as in (C). If slippage is felt 20 springs may be used. Clutch hub retaining nut should be torqued to 30 foot pounds.

CRANKCASE AND GEAR BOX. Transmission may be removed after dismounting engine from frame and separating crankcase halves.

Maico recommends using a hot plate or an oven to heat engine cases to 250 degrees F. for bearing removal or installation. Use of torch to heat cases is not recommended.

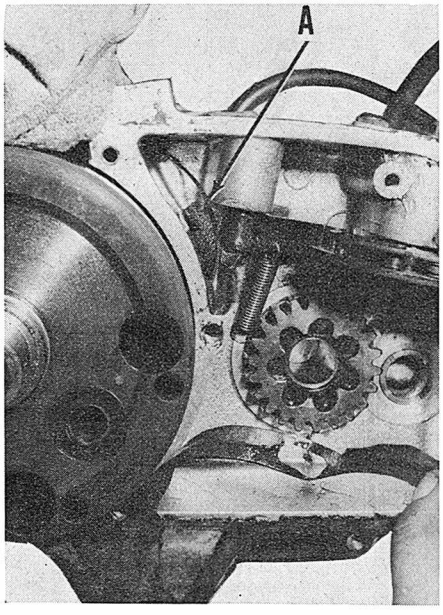


Fig. MA8—Spring clip with felt wiper (A) must be installed correctly to insure proper lubrication.

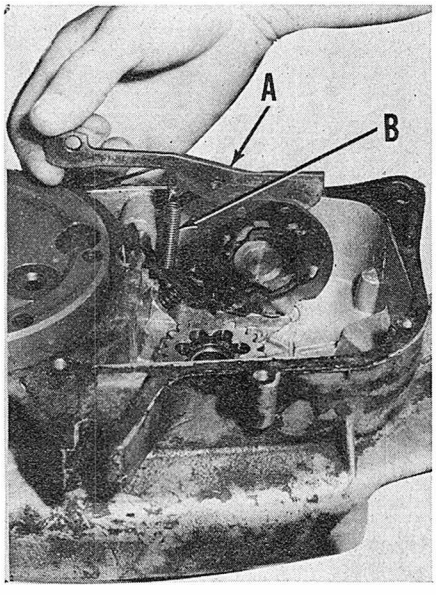


Fig. MA9—Arrangement of shift ratchet arm (A) and spring (B). Spring must be hooked on arm after installation of left case half.

Torque countershaft sprocket retaining nut to 40-50 foot pounds.

MONTESA

MONTESA MOTORS, INC.
3657 Beverly Blvd.
Los Angeles, California 90004

175, 250 AND 360 CC MODELS

MODEL	175	250	360
Displacement—cc	174.77	247.69	351.2
Bore—MM	60.9	72.5	78
Stroke—MM	60	60	73.5
Number of cylinders	1	1	1
Oil-Fuel ratio	1:20	1:20**	1:25
Plug gap—inch	0.016	0.016	0.016
Point gap—inch	0.015	0.015	0.015
Ignition timing	Fixed	Fixed#	Fixed
Degrees BTDC	23*	27##	23.5
Number of speeds	4	4†	4

*Impala Sport, Impala Cross and Enduro models are timed 25 degrees BTDC.
**Cappra models use a 1:25 oil to fuel mix.
#Impala-Cross models have an automatic timing advance.
##250 Trial is timed 23 degrees BTDC. Impala-Cross models are timed 32-36 degrees BTDC. La Cross models are timed 33 degrees BTDC.
†Cappra 250 Five and Cota models are equipped with five speed transmissions.

MAINTENANCE

SPARK PLUG. Recommended spark plug for normal use is listed below. Electrode gap for all models is 0.4 MM (0.016 in.)

175cc models	Bosch	Champion
Impala-Sport	W 260 T1	L-5
Impala-Cross	W 310 T16	L-58 R
Enduro	W 260 T1	L-5
Impala	W 225 T1	L-86
Comando	W 225 T1	L-86
Kenya	W 225 T1	L-86

250cc models	Bosch	Champion
Cappra Five	W 310 T17	N-58 R
Trial	W 225 T1	L-86
Impala-Cross	W 310 T16	L-58 R
Sport	W 260 T1	L-5
Cota	W 145 T1	L-10
Scorpion	W 260 T1	L-5
La Cross	W 310 T16	L-58 R
Cappra	W 310 T16	L-58 R
360cc models		
Cappra	W 310 T17	N-58 R

CARBURETOR. Refer to Figs. M1 and M2 for views of IRZ and Amal carburetors. Idle mixture is adjusted at needle (1) and idle speed at screw (7). Normal setting for idle mixture needle is 1-2 turns open. Clip (4) should be installed in middle groove of needle (5). Refer to the following carburetor specifications.

175cc Models	Amal	IRZ
Impala-Sport	376/25	22AEO/1
Main jet (13)	190	116
Pilot jet (6)	20	45
Impala-Cross	376/27	.....
Main jet (13)	260-280	.....
Pilot jet (6)	20	.....
Enduro	.....	22.1 - EC
Main jet (13)	.....	103
Pilot jet (6)	.....	41
Impala	.....	22.1 - EC
Main jet (13)	.....	103
Pilot jet (6)	.....	41
Comando	363/001-B	18-AEB
Main jet (13)	90	70
Pilot jet (6)	15	40
Kenya	375/22-4T.K	22.1 - ECB
Main jet (13)	100	98
Pilot jet (6)	20	42
250cc Models		
Cappra Five	389-B/32 MC	.....
Main jet (13)	280-300	.....
Pilot jet (6)	45	.....
250 Trial	.....	24 - EC
Main jet (13)	.....	110 - 115
Pilot jet (6)	.....	50
Impala-Cross	376/27 or 389/30	.....
Main jet (13)	270-300 or 290-350	.....
Pilot jet (6)	20	.....
Sport 250	389-B/30 MSE	.....
Main jet (13)	230	.....
Pilot jet (6)	37	.....
Cota 247	627	24 - EC
Main jet (13)	160	104-109
Pilot jet (6)	40	50
Scorpion	389-B/30 ME	.....
Main jet (13)	230	.....
Pilot jet (6)	35	.....
La Cross	389-B/30 MC	.....
Main jet (13)	260-290	.....
Pilot jet (6)	35	.....
Cappra	389-B/32 MC	.....
Main jet (13)	270-300	.....
Pilot jet (6)	40-45	.....
360cc Models		
Cappra	389-B/32 MC	.....
Main jet (13)	280-300	.....
Pilot jet (6)	45	.....

All specifications listed are suggested starting points for carburetor tuning. Operating conditions will dictate ideal settings and jet sizes.

IGNITION AND ELECTRICAL. Ignition breaker point maximum gap should be 0.4 MM (0.016 in.) for all models. Refer to CONDENSED SERVICE DATA table for recommended ignition timing. Piston position and crankshaft location is listed below.

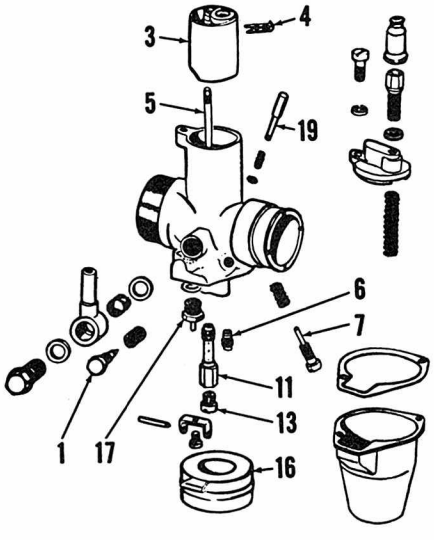


Fig. M1—View of IRZ single needle carburetor. Refer to Fig. M2 for legend.

Crankshaft location— 175 & 250cc models	Piston position BTDC
23 degrees BTDC	3.0 MM 0.118 in.
25 degrees BTDC	3.5 MM 0.138 in.
27 degrees BTDC	4.0 MM 0.157 in.
32 degrees BTDC	5.5 MM 0.217 in.
33 degrees BTDC	6.0 MM 0.236 in.
36 degrees BTDC	7.0 MM 0.275 in.
Crankshaft location— 360cc models	**Piston position BTDC**
23.5 degrees BTDC	3.0 MM 0.118 in.

Ignition timing can be changed by rotating the stator plate (2—Fig. M4) after removing flywheel and loosening the three mounting screws.

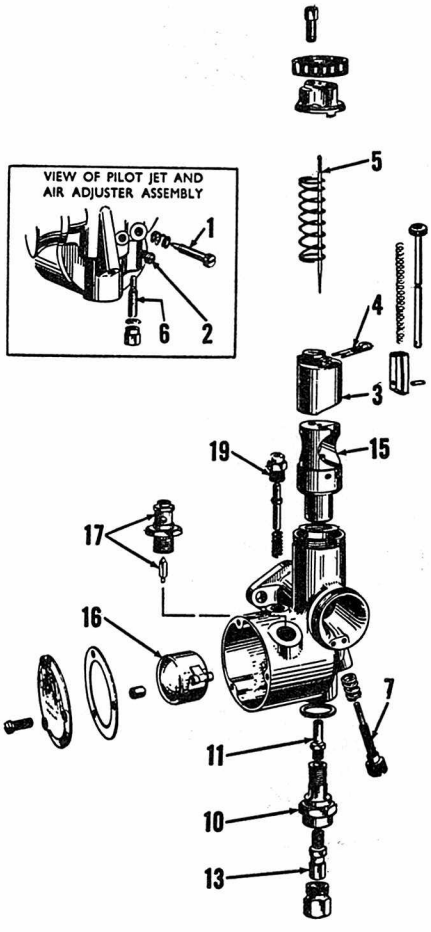
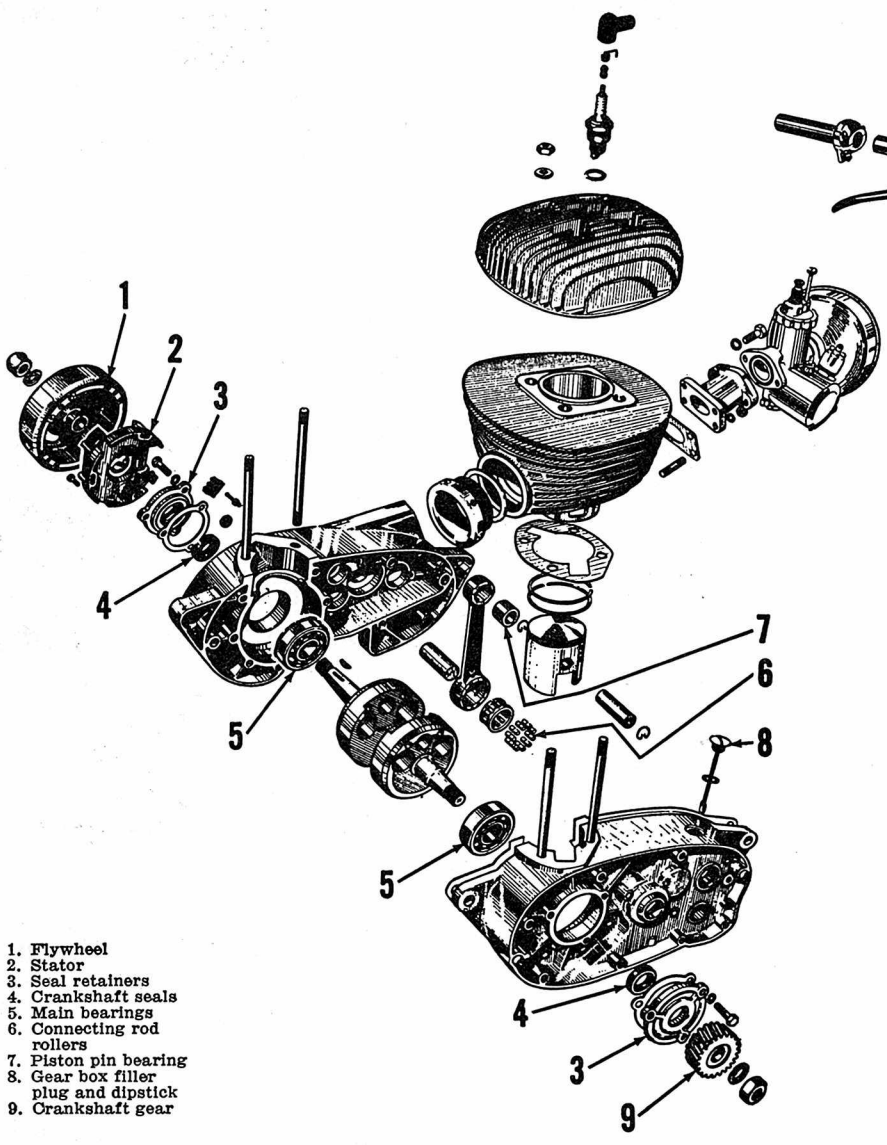


Fig. M2—Exploded view of Amal carburetor. Idle mixture is adjusted at needle (1) and idle speed at screw (7).

1. Pilot air (idle mixture) screw
2. Jet block locking screw
3. Throttle slide
4. Clip
5. Needle valve
6. Pilot jet
7. Idle speed adjusting screw
10. Nozzle holder
11. Needle jet
13. Main jet
15. Jet block
16. Float
17. Float valve
19. Primer

LUBRICATION. The engine is lubricated by mixing SAE 40 oil with the fuel. Normal ratio is 1:20, however Cappra 250 and 360cc models require a 1:25 oil to fuel mixture. The gear box contains SAE 90 oil and should be maintained at level marked on filler plug dipstick (8—Fig. M4). The clutch housing contains SAE20 (or SAE10W/30) motor oil and should be maintained at level marked on filler plug dipstick (32—Fig. M12).

CLUTCH CONTROLS. The clutch cable should be adjusted to provide 1-2 MM (0.039-0.078 in.) free play at A—Fig. M7. Adjustment is accomplished at cable adjuster located at hand lever end of cable.



1. Flywheel
2. Stator
3. Seal retainers
4. Crankshaft seals
5. Main bearings
6. Connecting rod rollers
7. Piston pin bearing
8. Gear box filler plug and dipstick
9. Crankshaft gear

Fig. M4—Exploded view of engine typical of all models.

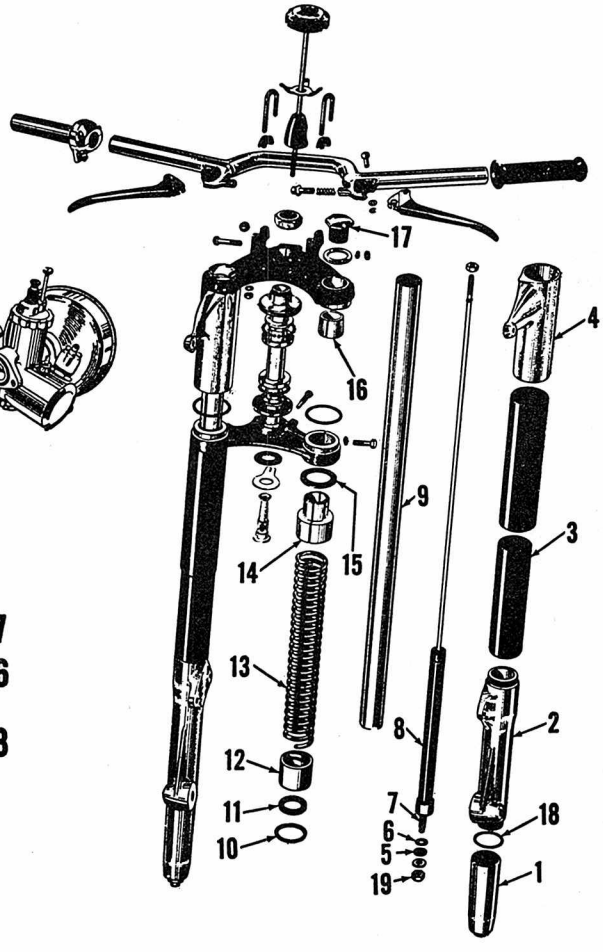


Fig. M9—Exploded view of front suspension system.

1. Lower cap
2. Fork support
3. Covers
4. Headlight bracket
5. Fiber washer
6. Gasket
7. Retaining stud
8. Damper
9. Tube
10. Gasket
11. Oil seal
12. Bushing
13. Spring
14. Spring seat
15. Dust seal
16. Clamp cone
17. Filler plug
18. Gasket
19. Nut

SUSPENSION. Refer to Fig. M9 for exploded view of front suspension system used on early models. Refer to Fig. M10 for later units. Front suspension can be drained by removing nuts (19) and cap (1). Each unit contains SAE 20 oil and is filled at plug (17). Refer to the following chart for fork leg capacities.

Oil capacity per leg—cc	Model
126	175 Impala Cross
148	175 (All other models) 250 Impala Cross Sport 250
163	Cappra 250 GP (sn/001-299)
170	Cappra 360 (sn/001-299)
185	Cappra 250
192	Cota 247 Scorpion Cappra 250 Five Cappra 250 GP (sn/300 and up) Cappra 360 (sn/300 and up)
222	LaCross 250
251	250 Trial

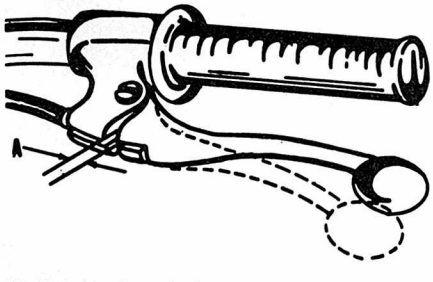


Fig. M7—Clutch hand lever should have 0.039-0.078 in. free play at A.

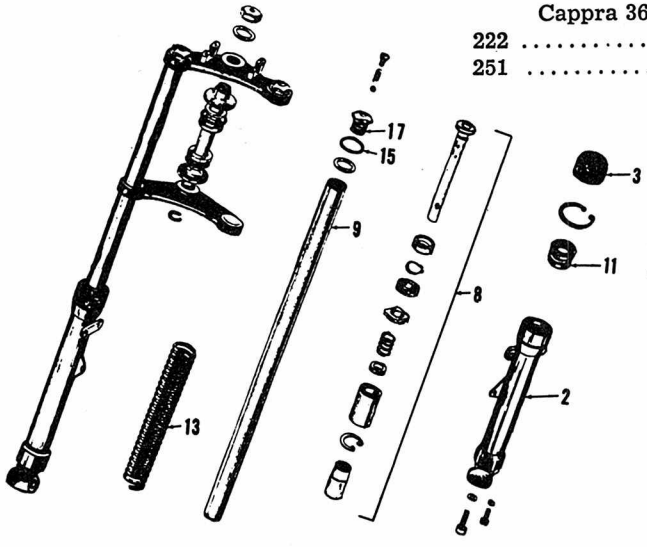


Fig. M 10 — Exploded view of front suspension unit typical of most late models. Refer to Fig. M 9 for legend.

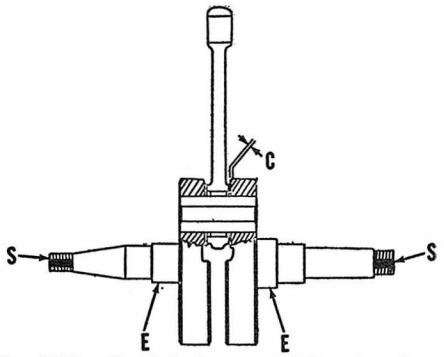


Fig. M11—Crankshaft eccentricity at main bearing journals (E) should be checked with crankshaft supported at ends. Rod side clearance is shown at (C).

Rear suspension units should be renewed if leaking or damaged.

REPAIRS

PISTON, RINGS AND CYLINDER. The piston can be removed after removing the exhaust pipe, carburetor, cylinder head and cylinder. Refer to the following specifications. Standard size and oversize piston and rings are available. The cylinder sleeve can be removed and installed after heating cylinder. Make certain ports are aligned when reassembling.

Standard cylinder bore diameter—

175cc .....2.3986-2.3990 inch

250cc

Cappra 250
LaCross 250
Cappra 250 Five
Cappra GP ....2.8566-2.8570 inch
Impala Cross ..2.8539-2.8543 inch
250 Trial
Sport 250
Cota 247 .....2.8561-2.8565 inch

360cc

Cappra 360 ....3.0722-3.0726 inch

Piston skirt-cylinder clearance—

175cc—

All models .....0.0012 inch

250cc—

Impala Cross .....0.0010 inch
Cappra 250 GP
Cappra 250 Five
Cappra 250
LaCross .....0.0039 inch
250 Trial
Cota 247
Sport 250 .....0.00334 inch

360cc—

All models .....0.00334 inch

Ring end gap 175cc ....0.20-0.35 MM 0.0078-0.0138 in.

Ring end gap 250cc ....0.20-0.35 MM 0.0078-0.0138 in.

Ring end gap 360cc ....0.30-0.45 MM 0.0118-0.0177 in.

Torque head nuts on 175cc models to 11-15 Foot-Pounds. On 250cc models that use only nuts on cylinder head to secure head and cylinder, torque nuts to 11-15 Foot-Pounds. On 250cc models that have nuts on cylinder base and nuts on head, torque cylinder nuts to 11-15 Foot-Pounds. and head nuts to 21-25 Foot-Pounds. 360cc models require 11-15 Foot-Pounds torque on head nuts, 21-25 Foot-Pounds on head bolts and 11-15 Foot-Pounds on cylinder hold down nuts.

CONNECTING ROD AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. The connecting rod is removed by pressing the crankshaft apart. Crankshaft should be disassembled **ONLY** if required tools are available to correctly check and align the reassembled crankshaft. With crankshaft supported at ends (S—Fig. M11) eccentricity at main bearing journals (E) should not exceed 0.01 MM (0.0004 in.). Connecting rod side play (C—Fig. M 11) should be within tolerance on following chart.

Model	Side clearance
175cc Models—	
Impala	0.004-0.006 inch
Enduro	0.008-0.012 inch
Kenya	0.004-0.006 inch
Comando	0.004-0.006 inch
Impala Cross	0.015-0.020 inch
Impala Sport	0.008-0.012 inch
250cc Models—	
Cappra 250 Five	0.016-0.019 inch
250 Trial	0.0078-0.0118 inch
Impala Cross	0.010-0.012 inch
Sport 250	0.016-0.019 inch
Cota 247	0.0078-0.0118 inch
Scorpion	0.016-0.019 inch
LaCross	0.016-0.019 inch
Cappra and GP	0.016-0.019 inch
360cc Models—	
Cappra 360 and GP	0.016-0.019 inch

CLUTCH. The multiple disc, wet type clutch is mounted on the left end of the transmission input shaft (Fig. M12). Clutch can be removed after removing crankcase left side cover and retaining nut (17). Pins (5) must be removed to disassemble clutch. Springs (12) should exert 28 Kgs (61.6 lbs.) when compressed to a height of 22 MM (⅞ in.) When reassembling, tighten nut (17) to 29 ft. lbs. of torque.

CRANKCASE AND GEARBOX. To disassemble the crankcase and gear box, it is necessary to remove the engine. Remove both left and right crankcase covers, magneto, crankshaft gear (9—Fig. M4), seal retainers (3), clutch assembly (Fig. M12) and output sprocket (1—Fig. M14).

1. Clutch lever
2. Release cam
3. Release plunger
4. Release pad
5. Retainer pins (6 used)
6. Cover
7. Internal plates (7 used)
8. External discs (6 used)
9. Clutch hub rollers (3 used)
10. Clutch hub
11. Pressure plate
12. Clutch springs (6 used)
13. Pins (6 used)
14. Clutch drum
15. Clutch hub bearing
16. Snap ring
17. Clutch retainer nut
18. Oil seal
19. Bushings
20. Snap ring
21. Washer
22. Selector shaft
23. Shift pawl (2 used)
24. Pawl spring
25. Stop plate
26. Shift quadrant
27. Eccentric (stop adjuster)
28. Return spring plate
29. Return spring center
30. Return spring
31. End plate
32. Clutch filler plug and dipstick
33. Shift pedal
34. Return spring pin

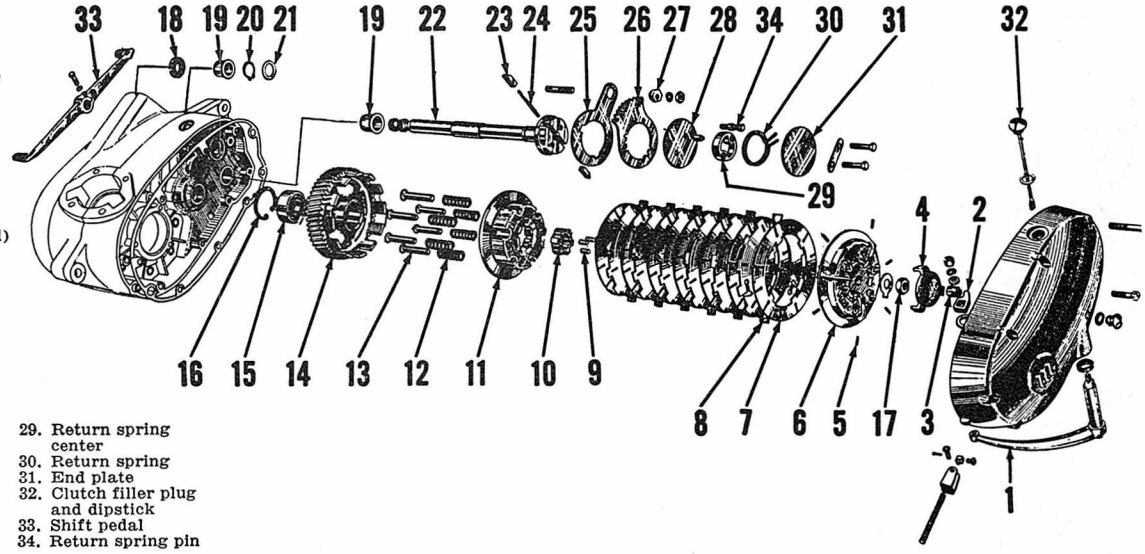


Fig. M12—Exploded view of clutch assembly and gear selector mechanism. Gear quadrant (26) meshes with left end of shift drum (11—Fig. M 14).

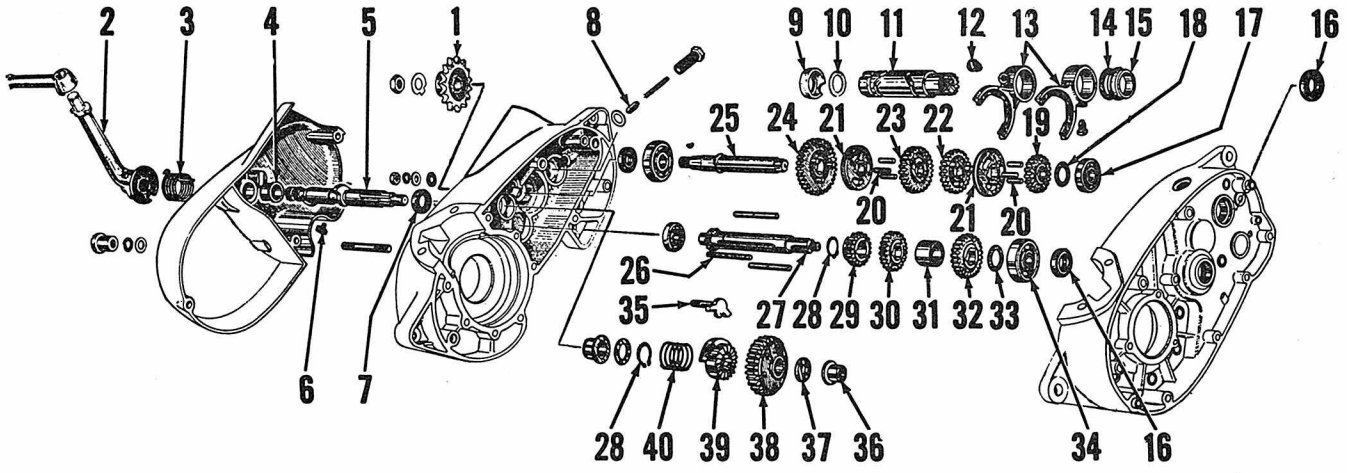


Fig. M14—Exploded view of transmission assembly. Shift forks (13) are interchangable.

1. Output sprocket
2. Kickstarter pedal
3. Return spring
4. Bushing
5. Starter shaft
6. Stop
7. Oil seal
8. Shift drum detent
9. Shift drum right cover
10. Shims
11. Shift drum
12. Shift fork guide pins (2 used)
13. Shift forks
14. Shims
15. Shift drum left cover
16. Oil seals
17. Bearing
18. Shims
19. Fourth gear
20. Shift collar drive pins (6 used)
21. Shift collars (2 used)
22. Third gear
23. Second gear
24. First gear
25. Output shaft
26. Gear drive rollers (6 used)
27. Input shaft and first gear
28. Snap rings
29. Second gear
30. Third gear
31. Spacer
32. Fourth gear
33. Shim
34. Bearing
35. Ratchet stop
36. Bushings
37. Washers
38. Kickstarter gear
39. Kickstarter ratchet
40. Ratchet spring

The transmission assembly is shown in Fig. M14. Shims (18 and 33) are used to limit end play of gears on the shaft to 0.2-0.3 MM (0.008-0.012 in.). Eccentric (27—Fig. M12) is used to adjust stop plate (25) so that pedal (33) will engage gears completely and stop movement at same time detent (8—Fig. M14) engages groove in shift drum (11).

MOTO BETA

MARCO DISTRIBUTING CO.
P.O. Box
Idaho Falls, Idaho

100CC MODELS

MODEL	XC100 Enduro Raider MX
Displacement-cc	98.2
Bore-MM	50
Stroke-MM	50
Number of cylinders	1
Oil-Fuel ratio	1:20
Plug gap-inch	0.022-0.024
Point gap-inch	0.014-0.018
Ignition timing	Fixed
Piston position BTDC-inch	0.092
Electrical system voltage	6
Tire size-Front	3.25x19
Rear	3.25x18
Tire pressure-Front	25 P.S.I.
Rear	28 P.S.I.
Rear chain free play-inch	½
Number of speeds	4
Weight-Lbs. (approx.)	172*

*Weight of Raider MX model is 160 lbs.

MAINTENANCE

SPARK PLUG. An NGK type B-7E or a Lodge type 2HLN with an electrode gap of 0.023 inch is recommended.

CARBURETOR. A Del'Orto 22 MM Concentric carburetor is used. (See Fig. MB 1) Normal adjustment of idle air screw (8) is 1¾-2 turns out from a lightly seated position. Refer to Fig. MB 1 and the following chart for standard jet sizes:

Main jet (15)	105
Slow jet (11)	40
Starter jet (10)	70
Jet needle (5)	260 U

Clip (4) should be set in middle notch of needle (5) for initial setting.

IGNITION AND ELECTRICAL. A six volt alternator mounted at the left end of crankshaft is used to produce electrical power for lighting and ignition. No battery is used. A cut out switch is mounted on the tail light assembly in the event that a filament is burnt out in tail light it may be bypassed to prevent engine stoppage when brake is applied.

Set point gap to 0.016 inch before timing engine. Three timing marks are located on the engine, one on the left hand case and two on the flywheel. When turning flywheel in normal direction of rotation, the first mark on flywheel will align with timing mark on case as piston reaches 28 degrees BTDC. Ignition points should just open at this time. Second mark will align as piston reaches TDC.

LUBRICATION. Transmission and clutch are lubricated by approximately 1 qt. of SAE 20W/40 motor oil. Oil should be drained and renewed every 3000 miles or about every 50 hours of operation.

Engine lubrication is accomplished by mixing gasoline with two cycle air cooled engine oil at a ratio of 24:1 for normal operation. The manufacturer recommends the use of Blendzall Racing Castor Oil or other concentrated lubricant mixed 40:1 for competition use.

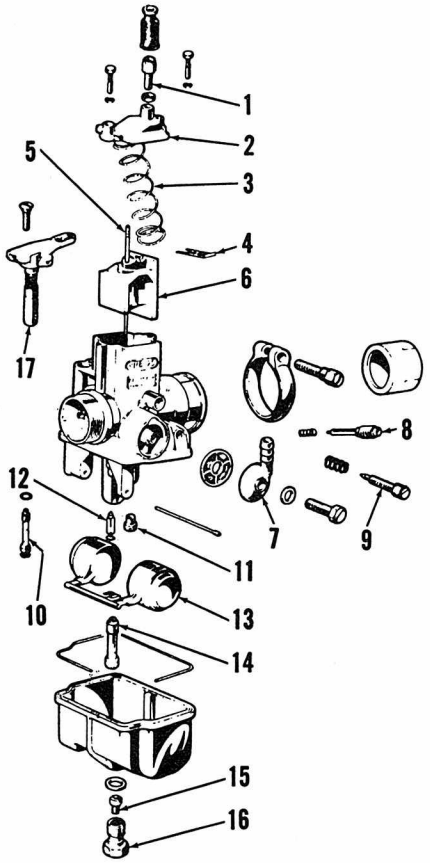


Fig. MB1 — Exploded view of Del'Orto 22 MM carburetor used on all models.

1. Cable adjuster
2. Mixing chamber top
3. Throttle return spring
4. Jet needle clip
5. Jet needle
6. Throttle slide
7. Fuel inlet fitting
8. Idle air adjustment
9. Idle speed adjustment
10. Starter jet
11. Slow jet
12. Float valve
13. Float
14. Needle jet
15. Main jet
16. Main jet holder
17. Starter plunger

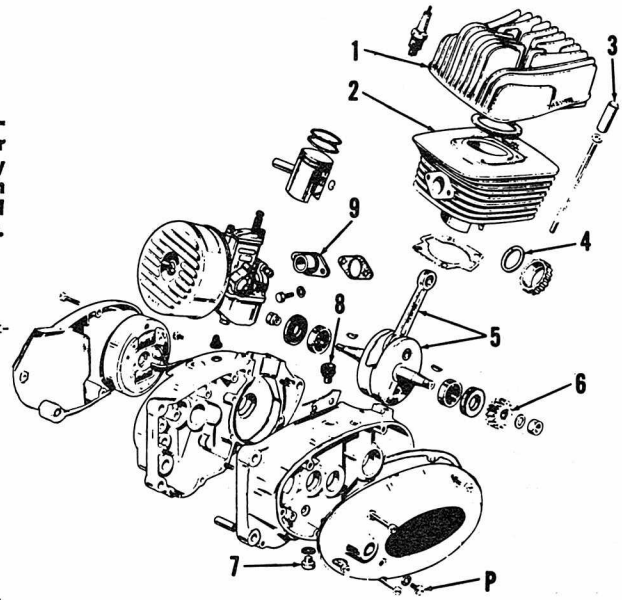


Fig. MB2 — Engine assembly used. Carburetor mounting flange (9) may have to be removed with carburetor intact to aid in removal of cylinder.

1. Cylinder head
2. Cylinder
3. Cylinder hold down nut
4. Exhaust gasket
5. Connecting rod and crankshaft assembly
6. Primary drive gear
7. Oil drain plug
8. Oil filler plug
9. Carburetor mounting flange

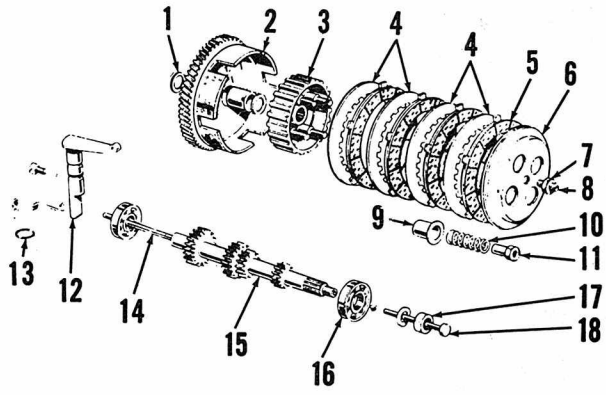


Fig. MB4 — Component parts of clutch assembly and actuating parts.

1. Thrust washer
2. Primary drive hub
3. Clutch hub
4. Steel plates
5. Friction discs
6. Pressure plate
7. Lock nut
8. Adjusting screw
9. Spring cup
10. Clutch spring
11. Spring holder
12. Release lever
13. "O" ring
14. Push rod
15. Primary shaft
16. Ball bearing
17. Clutch hub securing nut
18. Operating rod

CLUTCH CONTROLS. Adjust clutch cable at either end to obtain ¼-inch free play in lever on handle grip. To adjust clutch, remove kick-start lever and right side engine cover. Loosen lock nut on adjusting screw (8—Fig. MB 4) and back screw out until loose. Turn screw in until a slight resistance is felt and then back it out ½ turn and tighten lock nut (7).

SUSPENSION. Each front suspension unit contains 120cc of SAE 40 motor oil. Oil quantity may be in-

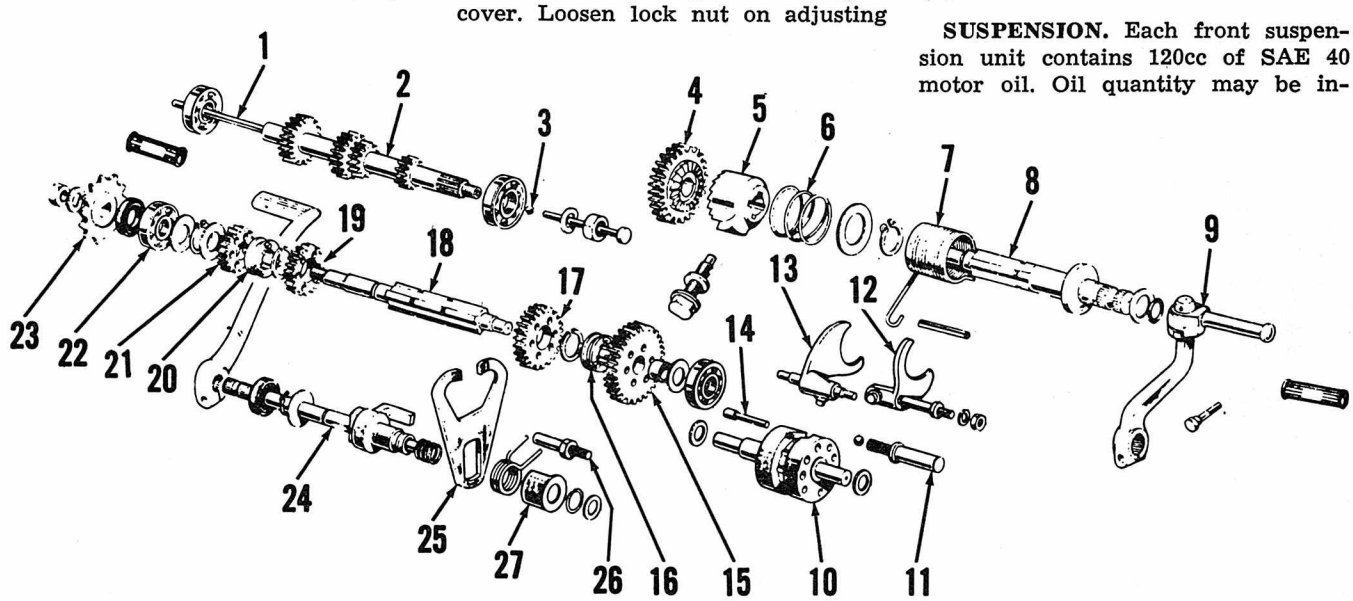


Fig. MB6—Exploded view of transmission and kickstarter assembly.

1. Clutch actuating rod
2. Primary shaft
3. Steel ball
4. Kickstarter gear
5. Kickstarter gear
6. Push spring
7. Return spring
8. Kickstarter shaft
9. Kick lever
10. Shift drum
11. Shift detent spring holder
12. Shift fork
13. Shift fork
14. Shift drum pin
15. First gear
16. First & second gear slider
17. Second gear
18. Secondary shaft
19. Third gear
20. Third & fourth gear slider
21. Fourth gear
22. Ball bearing
23. Drive sprocket
24. Shift shaft
25. Operating fork
26. Return spring pin
27. Shift spring cup

creased 20cc if more dampening is desired. Fork oil should be drained and renewed twice a year.

Rear suspension units are not repairable and should be renewed if leaking or damaged.

REPAIRS

CYLINDER, PISTON AND RINGS. Cylinder and piston may be removed without dismounting engine from frame. Refer to the following repair specifications:

Piston skirt to cylinder clearance—
(Normal use) ....0.003-0.0035 inch
(Competition use)..0.005-0.006 inch
Piston ring end gap ..0.008-0.013 inch
Maximum cylinder taper or
out of round .....0.002 inch

Install piston with ring lock pins toward rear (intake side) of cylinder. If a new piston is fitted it will be necessary to drill two 3/32 inch holes, one on the bottom of each pin boss. After drilling the lubrication holes in the pin bosses, ream the pin hole for a snug but not binding fit of piston pin.

Any play in small end rod bushing will warrant renewal of bushing. File a notch in old bushing and pull out. Press or pull a new bushing in place (do not pound bushing in) and drill two holes in bushing using; the existing holes in rod as guides. Ream bushing after drilling holes so that piston pin is a snug fit. Take precautions to prevent metal chips from falling in open crankcase. Five oversizes of pistons are available.

Torque head retaining nuts to 12 Foot-Pounds using a cross pattern to prevent warpage.

CRANKSHAFT AND CRANKCASE. Crankcase halves must be separated to remove the crankshaft. Crankshaft should only be disassembled if proper tools are available to reassemble correctly. Maximum crankshaft runout is 0.0005 inch.

Keyslot for primary gear woodruff key is different on some models. If a replacement key does not readily fit, key may be modified.

CLUTCH. Clutch is a wet multi-disc unit operated by a push rod running through the transmission shaft. Friction discs should be renewed if worn or chipped. Renew steel plates if warped or glazed.

TRANSMISSION. Inspect gears and gear dogs for wear or chipping. Reinstall thrust washers in original position on transmission shafts to retain proper fit in cases.

Renew both parts of kickstarter ratchet if either shows signs of excessive wear.

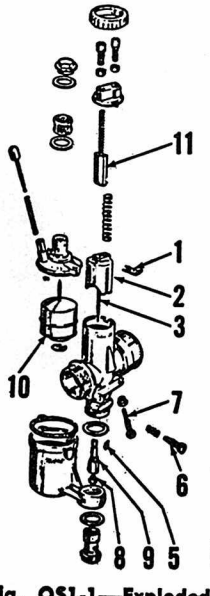
Pins in shift drum should fit securely.

OSSA

YANKEE MOTOR CORP.
P.O. Box 36
Schenectady, N.Y. 12301

160 AND 175CC MODELS

MODEL	160	175
Displacement-cc	160	175
Bore-MM	58	60.9
Stroke-MM	60	60
Number of cylinders	1	1
Oil-fuel ratio	1 to 20	1 to 20
Plug gap-inch	0.018	0.018
Point gap-inch	0.016	0.016
Ignition timing	fixed	fixed
Piston position-inch BTDC	——0.087-0.098——	
Electrical system voltage	12	12
Tire size	2.75x18	2.75x18 or 3.00x18
Tire pressure psi-front	18-10	18-19
Rear-solo	24-25	24-25
Rear chain free play-inch	¾-1	¾-1
Number of speeds	4	4
Weight-lbs. (approx.)	190	190-207



1. Clip
2. Throttle slide
3. Valve needle
5. Minimum jet
6. Idle mixture needle
7. Idle speed screw
8. Main jet
9. Nozzle
10. Float
11. Choke slide

Fig. OS1-1—Exploded view of Del' Orto carburetor typical of type used on 160cc models.

MAINTENANCE

SPARK PLUG. Recommended spark plugs for normal use are BERU type 260/14/3, Bosch type W260T2 or KLG type FE-100. For sustained high speed use, Bosch 310 or Lodge RL-47 spark plug is recommended. Electrode gap should be 0.018 inch.

CARBURETOR. The Del' Orto carburetor used on 160cc models is shown in Fig. OS1-1. Amal carburetor used on 175cc models is shown in Fig. OS1-2.

On Del' Orto carburetor, idle mixture is adjusted by turning needle

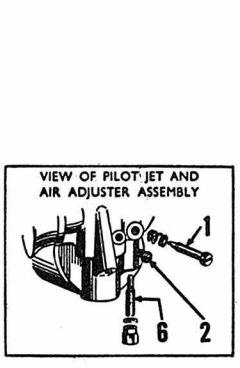


Fig. OS1-2—Exploded view of Amal carburetor typical of type used on 175cc models.

1. Pilot air (idle mixture) screw
2. Jet block locking screw
3. Throttle slide
4. Clip
5. Needle valve
6. Pilot jet
7. Idle speed adjusting screw
10. Nozzle holder
11. Needle jet
13. Main jet
15. Jet block
16. Float
19. Primer

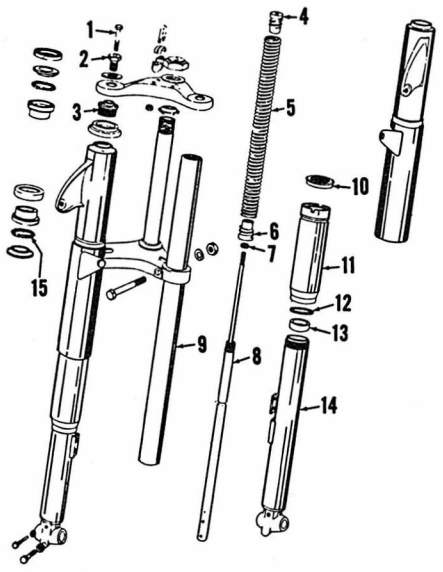


Fig. OS1-3—Exploded view of front suspension system.

1. Fitting screw
2. Upper plate fitting bolt
3. Fixed tube plug
4. Upper spring end
5. Spring
6. Lower spring end
7. Lock nut
8. Shock damper
9. Fixed tube
10. Retainer
11. Lower guard
12. Gasket
13. Bushing
14. Sliding tube
15. Bearing balls (28 used)

(6—Fig. OS1-1). Idle speed is changed by turning stop screw (7).

On Amal carburetor, idle mixture is adjusted by turning needle (1—Fig. OS1-2). Idle speed is changed by turning stop screw (7).

IGNITION AND ELECTRICAL. Ignition breaker point maximum gap should be 0.4MM (0.016 inch). Ignition timing (points just open) should occur when the piston reaches 2.2-2.5MM (0.087-0.098 inch) BTDC. If ignition timing is incorrect, the flywheel should be removed and magneto stator plate relocated. Make sure that breaker point gap is correctly set before changing the ignition timing.

LUBRICATION. The engine is lubricated by mixing SAE 40 oil with the fuel. Normal ratio is 1:20 after the first 300 miles. During break in (first 300 miles), oil to fuel ratio should be 1:14. The clutch and transmission are lubricated by approximately 1 quart of SAE 40 oil contained in the gear box. Oil in gear box should be changed every 1,200 miles.

CLUTCH. The clutch cable should be adjusted to provide some free play. In addition to cable guides, adjustment can be accomplished by turning screw (8—Fig. OS1-6) after loosening the lock nut.

SUSPENSION. Refer to Fig. OS1-3 for exploded view of front suspension unit. Rear suspension unit is shown in Fig. OS1-4.

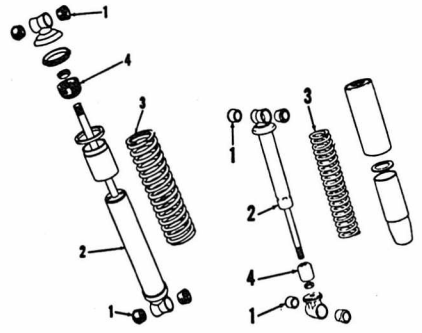
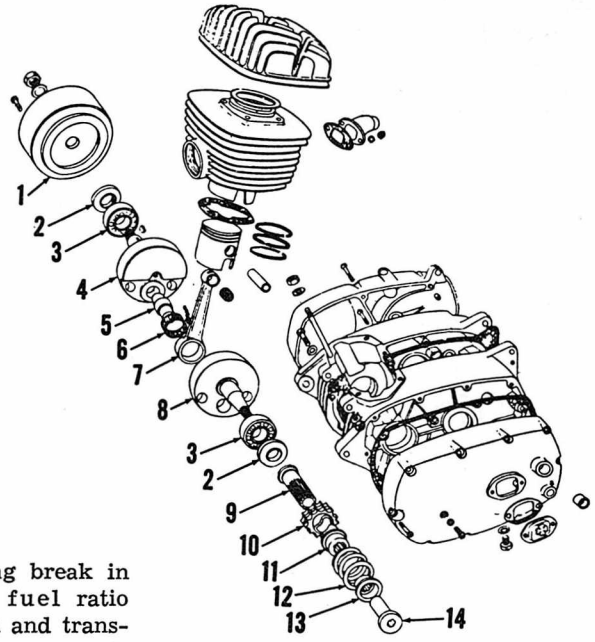


Fig. OS1-4 — Exploded view of the two types of rear suspension units used.

1. Rubber bushings
2. Shock absorber
3. Spring
4. Bumper

Fig. OS1-5 — Exploded view of the crankshaft and associated parts.

1. Ignition assembly
2. Seals
3. Main bearings
4. Flywheel and right main journal
5. Crankpin
6. Bearing cage and 28 rollers
7. Connecting rod
8. Flywheel and left main journal
9. Coupling spline
10. Crankshaft sprocket
11. Coupling
12. Spring
13. Spring cap
14. Retainer nut



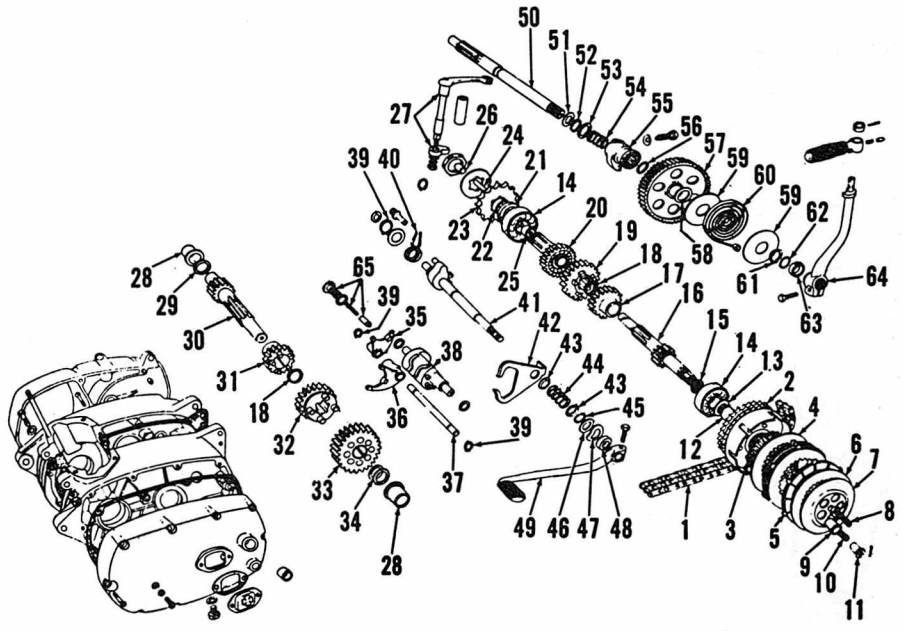


Fig. OS1-6—Exploded view of the transmission and clutch.

1. Primary drive chain
2. Clutch drum
3. Hub
4. Inner (thick) plate
5. Friction discs (4 used)
6. Driven plates (4 used)
7. Pressure plate
8. Adjusting screw
9. Spring cup
10. Spring
11. Spring nut
12. Bushing
13. Thrust washer
14. Ball bearing
15. Washer
16. Input shaft
17. Gear (2nd)
18. Snap rings
19. Sliding gear
20. Output shaft and gear
21. Oil seal
22. Spacer
23. Output sprocket
24. Clutch rod
25. Seal
26. Clutch roller
27. Clutch lever
28. Bushings
29. Thrust washers
30. Countershaft
31. Gear (3rd)
32. Sliding gear
33. Gear (1st)
34. Shims
35. Shift fork (2nd & 4th)
36. Shift fork (1st & 3rd)
37. Rail
38. Shift drum
39. Snap rings
40. Return spring
41. Change shaft
42. Shift yoke
43. Spring seats
44. Spring
45. Snap ring
46. Thrust washer
47. Spring washer
48. Oil seal
49. Gear change pedal
50. Starter shaft
51. Thrust washer
52. Snap ring
53. Spring seat
54. Spring
55. Kick starter ratchet
56. Washer
57. Pinion
58. Thrust washer
59. Washers
60. Return spring
61. Snap ring
62. Oil seal
63. Ring
64. Kick starter pedal
65. Shift detent assembly

SACHS

FICHTEL & SACHS AG
Schweingurt, Germany

Gene Shillingford & Sons, Inc.
Radcliffe & Green Lane
Bristol, Pa. 19007

50, 80, 100 AND 125CC MODELS

Sachs engines are used in many different motorcycles, some of them being Sachs, Penton, Hercules and Sprite.

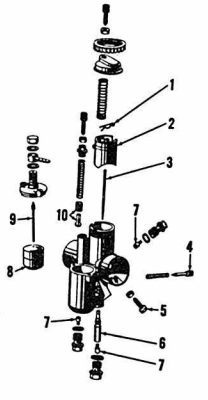
MODEL	K-50	K-80-S & K-80-GS	K-103	1001/5 A	1251/5 A
Displacement-cc	49	73	97	98	123
Bore-MM	38	46	48	48	54
Stroke-MM	44	44	54	54	54
Number of cylinders	1	1	1	1	1
Oil-fuel ratio	1 to 25	1 to 25*	1 to 25	1 to 25	1 to 25*
Plug gap-inch	0.020-0.024	0.020-0.024	0.020-0.024	0.020-0.024	0.020-0.024
Point gap-inch	0.016	0.016	0.016	0.016	0.016
Ignition timing	Fixed	Fixed	Fixed	Fixed	Fixed
Piston position BTDC-inch	0.06-0.08	0.06-0.08	0.10-0.12	0.118-0.138	0.118-0.138
Electrical system voltage	6	6	6	6	6
Number of speeds	5	5	4	5	5

*Some models have an automatic oil injection system.

MAINTENANCE

SPARK PLUG. Recommended spark plug for normal use is Bosch type W260T1 or W270T16 for 50 and 80cc models, Bosch M225P11S for 4 speed 100cc models, Bosch W260T1 for 125cc models and 5 speed 100cc models. Electrode gap for all models should be 0.020-0.024 inch.

CARBURETOR. Bing carburetors are used on all models. Type 1/17/55 is used on 50cc models, 1/18/15 is used on 80cc models and early (4-speed) 100cc models type 1/22/132, type 1/22/119, type 1/22/137 or type 1/22/164. Late 100cc models use Bing 1/22/158 and 125cc models use Bing 1/24/153. Initial setting for the idle mixture (4—Fig. SA1-1) is ½-turn open for 50 and 80cc models, 1-1½ turns open for early 100cc models; ½-¾ turn open for late 100cc models and 125cc models. On all models, idle speed is adjusted by turning stop screw (5). Refer to the following carburetor specification data:



1. Clip
2. Throttle slide
3. Valve needle
4. Idle mixture needle
5. Idle speed screw
6. Needle jet
7. Main jet (1 used)
8. Float
9. Fuel inlet valve
10. Starting valve

Fig. SA1-1—Exploded view of typical Bing carburetor used on some models. Main jet (7) is shown at three different possible locations.

Bing 1/17/55
Main jet (7) 85
Needle jet (6) 6447A
Valve needle (3) 46-123
Clip (1) in top groove of needle (3).

Bing 1/18/15
Main jet (7) 100
Needle jet (6) 6247A
Clip (1) in third groove from top of needle (3).

Bing 1/22/132
Main jet (7) 90
Needle jet (6) 1608
Clip (1) in third groove from top of needle (3).

Bing 1/22/119 and 1/22/164
Main jet (7) 100
Needle jet (6) 1608
Clip (1) in third groove from top of needle (3).

Bing 1/22/137
Main jet (7) 105
Needle jet (6) 1608
Clip (1) in third groove from top of needle (3).

Bing 1/24/150
Main jet (7) 95
Needle jet (6) 2.73
Clip (1) in second groove from top of needle (3).

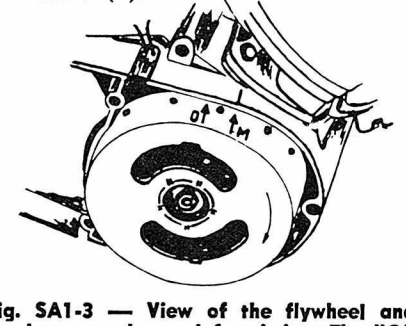


Fig. SA1-3 — View of the flywheel and crankcase marks used for timing. The "O" mark indicates piston top dead center and "M" mark indicates position BTDC when ignition points should open and spark plug should fire.

Bing 1/24/153
Main jet (7) 100
Needle jet (6) 2.73
Clip (1) in third groove from top of needle (3)

IGNITION AND ELECTRICAL. Ignition breaker point gap should be 0.014-0.018 inch and can be set through holes in the flywheel. Ignition breaker points should just open when the "M" mark on flywheel is aligned with mark on crankcase as shown in Fig. SA1-3. If timing is incorrect, the stator plate can be moved after loosening the three retaining screws. The timing marks on flywheel and crankcase should align when the piston is 0.06-0.08 inch before Top Dead Center on 50 and 80cc models; 0.10-0.12 inch BTDC on early 100cc models and 0.118-0.138 inch on 5-speed 100cc and 125cc models. The "O" mark on flywheel is Top Dead Center. The flywheel nut should be tightened to 39-40.5 Ft.-Lbs. torque on all models except 5-speed 100cc and 125cc models which only require 28-29 Ft.-Lbs. torque.

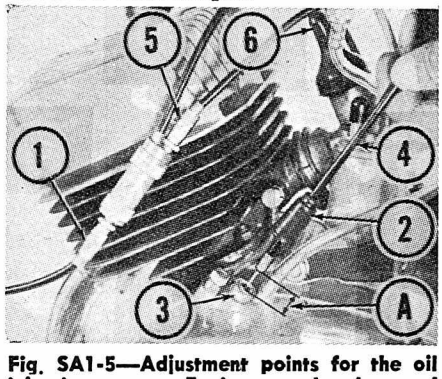


Fig. SA1-5—Adjustment points for the oil injection system. Engine may be damaged if incorrectly adjusted.

1. Hand lever cable guide
2. Rubber cover
3. Bushing
4. Oil pump
5. Oil pump control cable cable guide
6. Carburetor cable guide

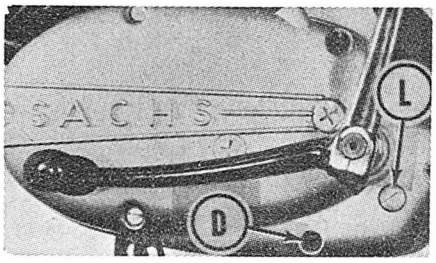


Fig. SA1-6—Gear box oil for all models except 100 cc 4-speed should be maintained at level of plug (L).

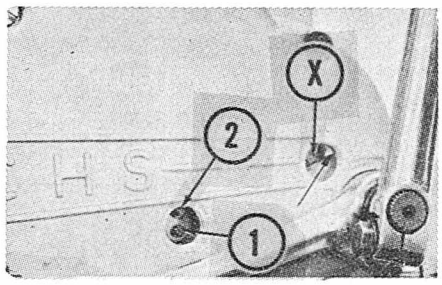


Fig. SA1-8—View of clutch adjustment points. Refer to text.

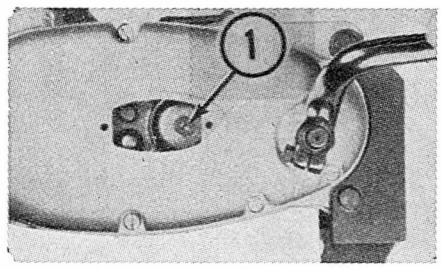


Fig. SA1-9—View of clutch adjusting screw on 4-speed 100cc models. Refer to text for adjustment procedure.

LUBRICATION. On models without oil injection the engine is lubricated by mixing SAE 40 or 50 two stroke oil with the fuel. Ratio should be 1:25.

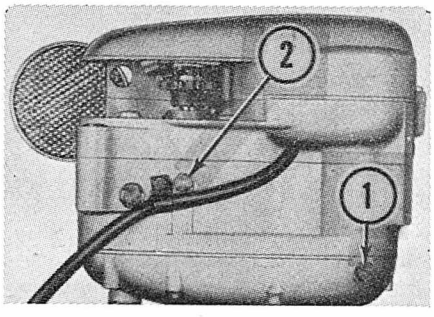


Fig. SA1-7—On 4-speed 100cc models, plug (1) should be removed to check oil level.

On models with automatic oil injection, the throttle and oil pump cables must be properly adjusted to provide the correct amount of oil. Turn the cable guide (1—Fig. SA1-5) until the hand lever cable has 0.04 inch free play. Adjust the cable guide (6) until the carburetor cable has very slight free play. Make sure that throttle slide is not pulled up. Remove the rubber cap (2) and pull the oil pump control cable (4) up as far as it will go. Distance (A) between top of bushing (3) and bottom of cable housing should be 0.650 inch. If distance (A) is incorrect, adjust by turning cable guide (5). If any part of the oil injection pump is damaged, the complete unit must be renewed.

On all except 100cc models with 4 speed transmission, the gear box

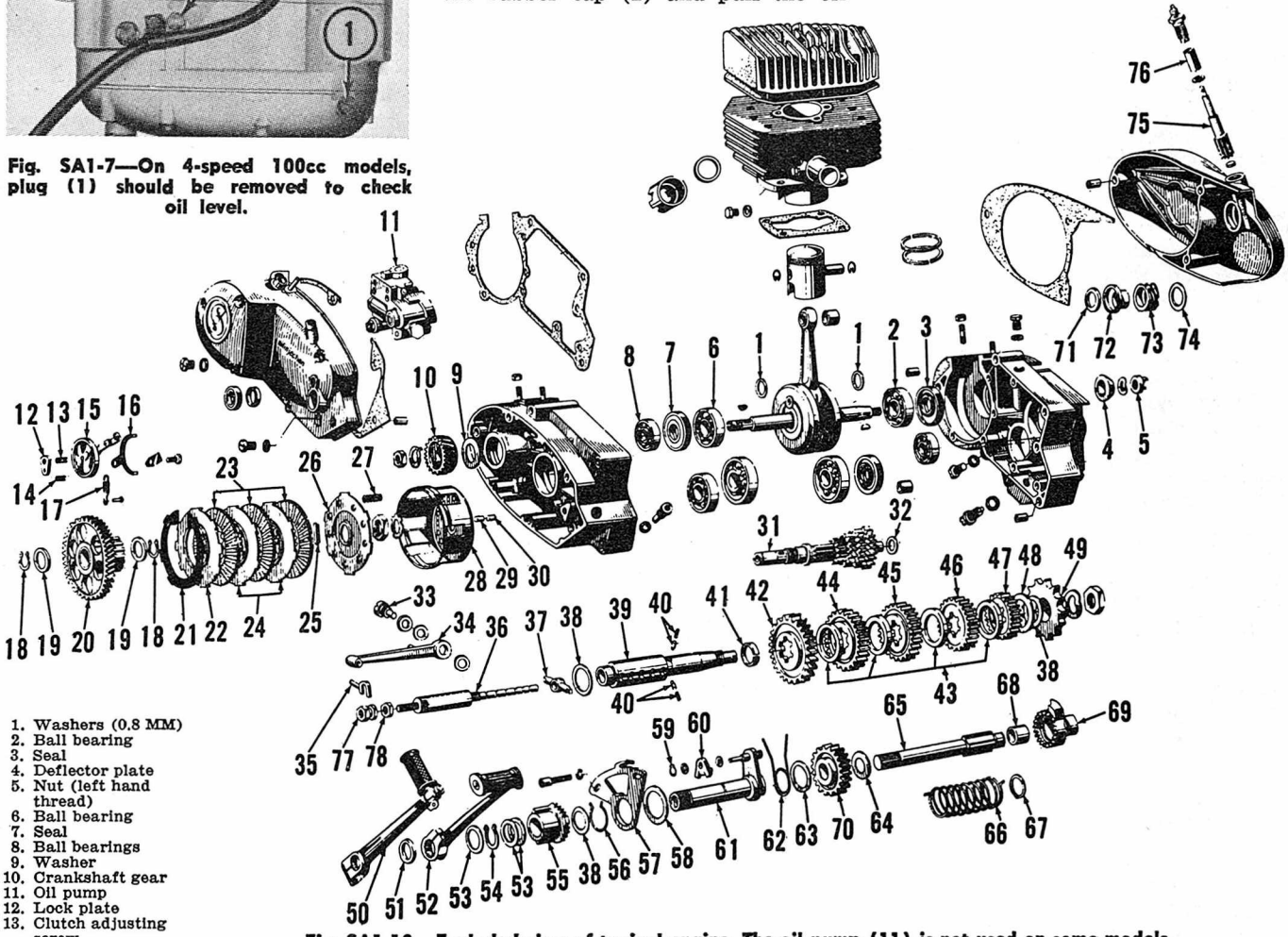


Fig. SA1-10—Exploded view of typical engine. The oil pump (11) is not used on some models.

1. Washers (0.8 MM)
2. Ball bearing
3. Seal
4. Deflector plate
5. Nut (left hand thread)
6. Ball bearing
7. Seal
8. Ball bearings
9. Washer
10. Crankshaft gear
11. Oil pump
12. Lock plate
13. Clutch adjusting screw
14. Lock screw
15. Cam cup
16. Spring
17. Spring
18. Snap ring
19. Shim
20. Primary drive gear and clutch hub
21. Snap ring
22. Cover plate
23. Friction disc
24. Steel plate
25. Pressure key
26. Pressure plate
27. Pressure spring
28. Clutch drum
29. Steel pin
30. Bronze pin
31. Input cluster gear
32. Shim
33. Pivot
34. Gear change lever
35. Shift fork
36. Selector rod
37. Shift dog
38. Shims
39. Output shaft
40. Detent
41. Detent retainer spring
42. Gear (1st)
43. Spacer rings
44. Gear (2nd)
45. Gear (3rd)
46. Gear (4th)
47. Gear (5th)
48. Shims
49. Output sprocket
50. Kick starter pedal
51. Seal
52. Gear selector pedal
53. Shims
54. Snap ring
55. Pawl spring
57. Selector adjusting plate
58. Washer
59. Snap ring
60. Selector pawl
61. Selector shaft
62. Return spring
63. Shim
64. Washer
65. Kick starter shaft
66. Kick starter spring
67. Washer
68. Bushing
69. Ratchet
70. Kick starter gear
71. Seal
72. Cup
73. Speedometer worm
74. Washer
75. Speedometer gear
76. Bushing
77. Shift groove nut
78. Lock nut

should be filled to level of plug (L—Fig. SA1-6) with SAE 80 oil. Capacity is 350cc on 50 and 80cc models without oil injection. On models with oil injection, capacity is 380cc. Capacity is 600cc for 100cc models with 5 speed transmission and 125cc models.

Oil capacity for gear box on 4 speed 100cc models is 450cc. To check the oil level, remove plug (1—Fig. SA1-7). Oil should be maintained just above stand pipe on plug (1). If oil does not begin to drip from plug (1) add SAE 80 oil at plug at top of crankcase.

On all models, oil in gear box should be changed every 3800 miles.

CLUTCH. On all except 4 speed 100cc models, remove the two plugs from left side cover (Fig. SA1-8). Loosen lock screw (1) and turn screw (2) counter-clockwise 1 turn. Turn the cable adjuster (guide) on the hand lever in. Pull the clutch hand lever slightly and observe the clutch lever (X). The cable adjuster on hand lever should be adjusted so that lever (X) rests on the stop (at arrow) and just begins to move when the hand lever is depressed approximately $\frac{1}{16}$-inch. After cable is adjusted, turn screw (2) until slight resistance is felt, then back screw out ½-turn and tighten the lock screw (1).

On 100cc 4 speed models, loosen lock nut and turn screw (1—Fig. SA1-9) until clutch actuating lever on top of crankcase has 0.3-0.4 inch free play at end. Tighten lock nut. Free play at hand lever is adjusted by turning the cable guide at the hand lever end.

REPAIRS

PISTON, RINGS AND CYLINDER. The piston can be removed after removing the cylinder. The piston and rings are available in standard size and three oversizes.

When reassembling, heat piston to 160-175 degrees F. and assemble to rod with arrow on top of piston toward front. Make sure that rings correctly engage the pins in groove when positioning the cylinder.

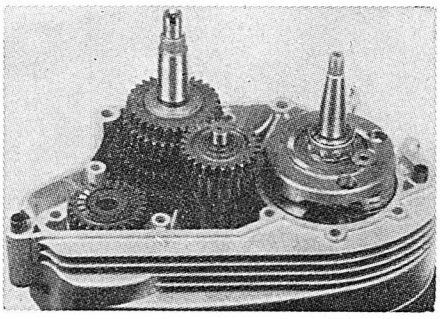


Fig. SA1-14—View of transmission gears positioned in the left crankcase half. Typical of most models.

CONNECTING ROD AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. The connecting rod, crankpin, rod bearing and crankshaft are available only as a complete unit.

When removing and installing bearings in crankcase halves, the crankcase should be heated to 160-175 degrees F. Crankshaft main bearings (2 & 6—Figs. SA1-10 and SA1-12) should be removed and installed with a spe-

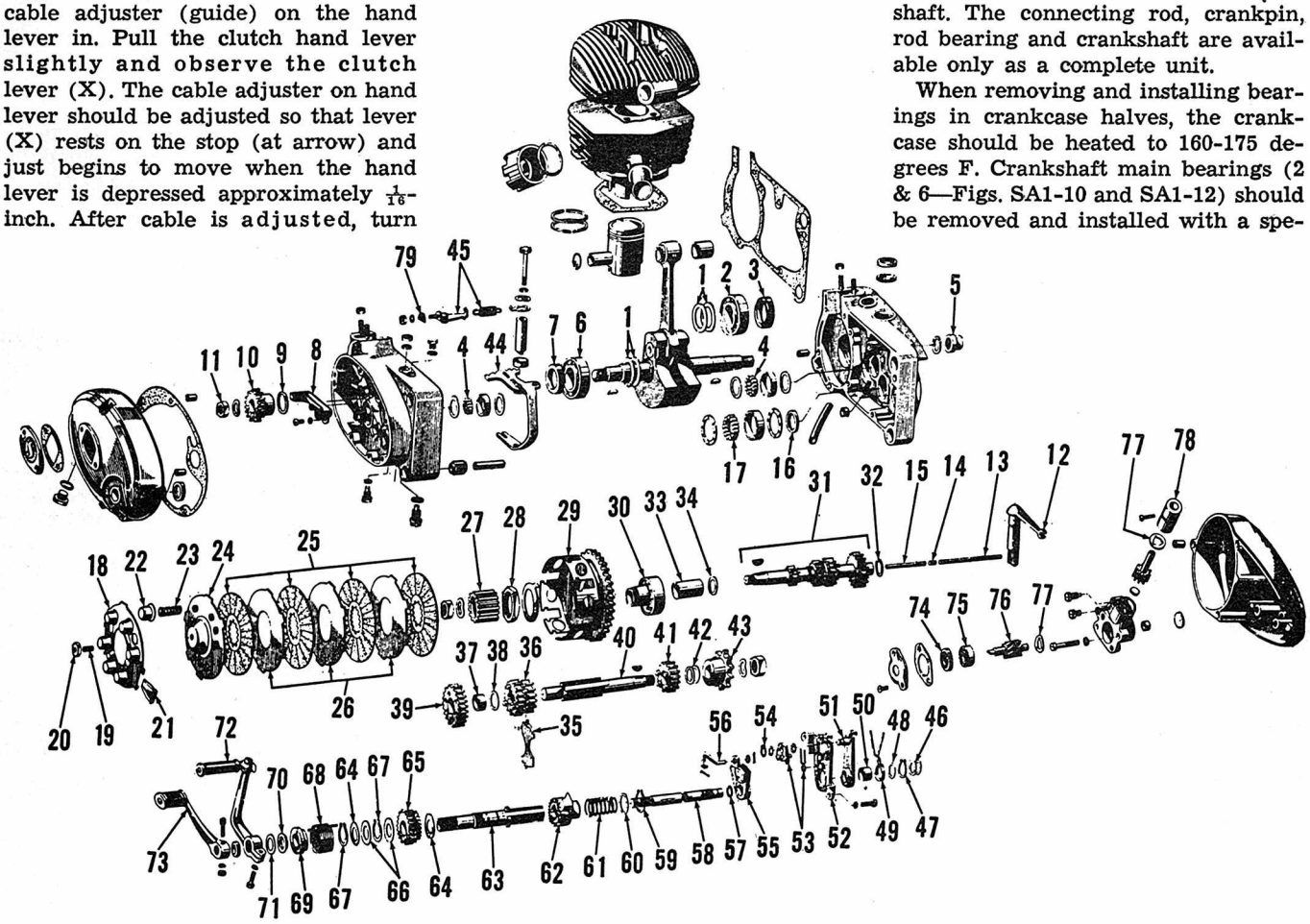


Fig. SA1-12—Exploded view of the K-103 engine and transmission assembly.

1. Shims
2. Ball bearing
3. Seal
4. Input shaft bearing rollers (13 each race)
5. Nut
6. Bearing (same as 2)
7. Seal (same as 3)
8. Oil channel
9. Shim
10. Crankshaft sprocket
11. Nut (left hand thread)
12. Clutch lever
13. Clutch rod (long)
14. Push roller
15. Clutch rod (short)
16. Oil seal
17. Output shaft bearing rollers (15 used)
18. Spring retainer
19. Clutch adjusting screw
20. Lock nut
21. Lock plate (2 used)
22. Spring cup
23. Spring
24. Pressure plate
25. Friction discs
26. Clutch plates
27. Clutch hub
28. Bearing nut
29. Clutch drum
30. Bearing
31. Input shaft assembly
32. Shims
33. Bushing
34. Thrust washer
35. Shift bridge
36. Sliding gear
37. Bushing
38. Thrust washer
39. First gear
40. Output shaft
41. Fourth gear
42. Shims
43. Output sprocket
44. Selector fork
45. Detent pawl and spring
46. Shims
47. Snap ring
48. Washer
49. Return spring
50. Spacer
51. Lever
52. Adjuster plate
53. Pawl and spring
54. Snap ring
55. Shift lever
56. Shift link
57. Shim
58. Shift pedal shaft
59. Snap ring
60. Washer
61. Spring
62. Ratchet wheel
63. Kick starter shaft
64. Shim
65. Kick starter gear
66. Shim
67. Snap ring
68. Return spring
69. Spring retainer
70. Shim
71. Seal
72. Kick starter pedal
73. Shift pedal
74. Seal
75. Bearing
76. Speedometer worm
77. Shim
78. Bushing
79. Shims

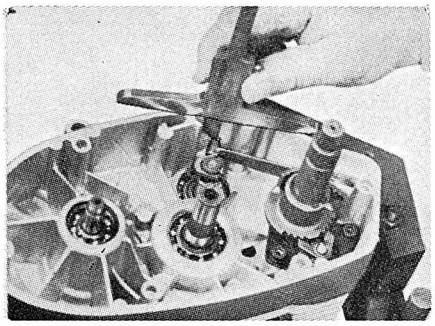


Fig. SA1-15—Refer to text for measuring and setting the gear shift assembly on 50 and 80cc models.

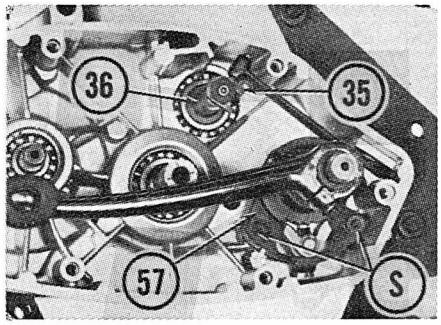


Fig. SA1-16—View of the shift assembly on 50 and 80cc models. Refer to text when adjusting.

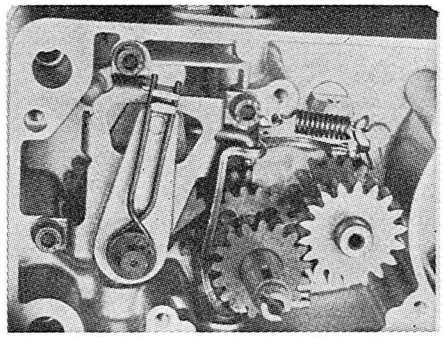


Fig. SA1-17—View of 4-speed transmission assembled in the left half of crankcase.

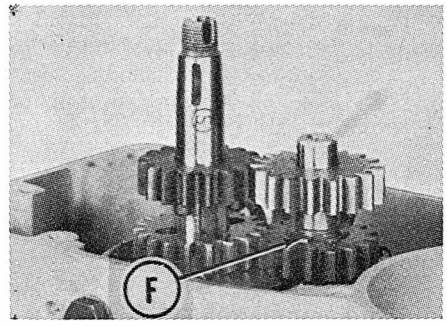


Fig. SA1-18—In third gear, pawls should be 0.02 inch above face of gears as shown. Refer to text.

cial puller attached to end of crankshaft. If bearings are driven on, the connecting rod bearing or crankshaft alignment may be damaged.

On 50 and 80cc models, thrust washers (1—Fig. SA1-10) are 0.8MM thick and crankshaft end play is not adjusted. On 100cc and 125cc models, shims (1— Fig. SA1-12) should be distributed evenly on both sides to allow crankshaft 0.1-0.2MM (0.004-0.008 inch) end play. End play can be determined by measuring depths of inner bearing races from mating surfaces of crankcase halves and width of shoulders on crankshaft. Make certain that gasket is measured with one half of crankcase.

CRANKCASE AND GEAR BOX. The crankcase halves can be separated after removing the cylinder, piston, magneto assembly, clutch, crankshaft gear (or sprocket) and output sprocket. Remove the screws attaching halves together, carefully separate the halves making certain that gasket sealing surfaces are not damaged.

On 50 and 80cc models, vary the number of shims (32, 48 & 63—Fig. SA1-10) to provide the shafts with end play equal to the thickness of the gasket between crankcase halves. When installing the shift assembly, shift the transmission to third gear. NOTE: Make sure that transmission is in third gear. Measure the distance between the surface of crankcase to the edge of shift fork (35—Fig. SA1-10) as shown in Fig. SA1-15. If distance is not 0.913 inch (23.2MM), loosen the lock nut and turn the shift groove nut (77—Fig. SA1-10) as required. Measure again after tightening lock nut to make sure adjustment has not been changed. Engage first gear and press on gear shift pedal. The shift rod (36—Fig. SA1-16) should not move and shift fork (35) should be loose. If not, loosen screws (S) and move the adjusting plate (57) slightly and recheck. The same conditions should exist when checking the fifth gear.

On 100cc and 125cc models, refer to Figs. SA1-12 and SA1-17 when assembling. Before assembling the crankcase halves, shift the transmission to third gear and check the faces of splines (F—Fig. SA1-18). The splines should be 0.0019 inch (0.05MM) above the face of gear. If adjustment is incorrect, it is necessary to remove the pawl (45—Fig. SA1-12) and vary the number of shims (79) as required. The faces of first gear (39) and starter gear (65) should be flush. If incorrect, vary the number of shims (66) as required. End play of starter shaft (63) should be adjusted to 0.004 inch (0.1MM) by varying shims (70). Check engagement of gears before assembling crankcase halves. When the gear change lever is moved fully in either direction, the pawl (45) should always fully engage notches in selector fork (44). If the selector fork moves too far or not far enough, loosen the retaining screws and move plate (52) slightly and recheck. End play of shift pedal shaft (58) should be 0.004 inch (0.1MM) and is adjusted by adding shims (46).

On all models, the gasket between crankcase halves should be coated with a non hardening sealer. The screws attaching crankcase halves together should be tightened to 72-84 inch pounds torque. On 50 and 80cc models, tighten the clutch drum nut to 37-39 Ft.-Lbs. torque. On four speed 100cc models, clutch drum retaining nut should be tightened to 17.5-18.5 Ft.-Lbs. torque. On five speed 100cc and 125cc models clutch drum retaining nut should be torqued to 58-65 Ft.-Lbs.

SUZUKI

SUZUKI MOTOR CO., LTD.
Hamamatsu, Japan
U. S. SUZUKI MOTOR CORP.
13767 Freeway Drive
Santa Fe Springs, Calif. 90670

50, 55 AND 80CC PISTON PORT MODELS

MODEL	M12 & M15	M31	K10 & K11	K10P, K11P & K15P	K15
Displacement-cc	50	55	79	79	79
Bore-MM	41	43	45	45	45
Stroke-MM	38	38	50	50	50
Number of cylinders	1	1	1	1	1
Oil-fuel ratio	1 to 20	1 to 20	1 to 20	Oil Pump	1 to 20
Plug gap-inch	0.020-0.024	0.020-0.024	0.020-0.024	0.020-0.024	0.020-0.024
Point gap-inch	0.014	0.014	0.014	0.014	0.014
Ignition timing-Advance	Fixed	Fixed	Fixed	Fixed	Fixed
Degrees BTDC	27	20	27	20	27
Electrical system voltage	6	6	6	6	6
Tire size	2.25 X 17	2.25 X 17	2.50 X 17	2.50 X 17	2.75 X 17
Tire pressure psi-front	24	24	24	20	19
Rear	31	31	31	28	27*
Rear chain free play-inch	1½	1	1	1	¾
Number of speeds	4	3	4	4	4
Weight-lbs. (Approx.)	145	132	154	167	165

*Rear tire pressure should be 32-35 psi for carrying passenger.

MAINTENANCE

SPARK PLUG. Spark plug electrode gap should be 0.5-0.6 MM (0.020-0.024 in.) for all models. Standard spark plug is NGK type B-6 or B-7; however, Champion HO-3 (or UJ-7P) or J-5, AC type 43 or 42, KLG type FS70 or FS75, Autolite A3 or AT4 or Bosch W225T3 can be used.

CARBURETOR. Mikuni VM15SC carburetor is used on 50 and 55cc models. VM17SC and VM20SH are used on 80cc models. Due to varying conditions, changes may be required; however, normal specifications for carburetors are as follows:

50cc Models

Carburetor type VM15SC
Main jet (5—Fig. S1-2) 75-80
Needle jet (4) E-0

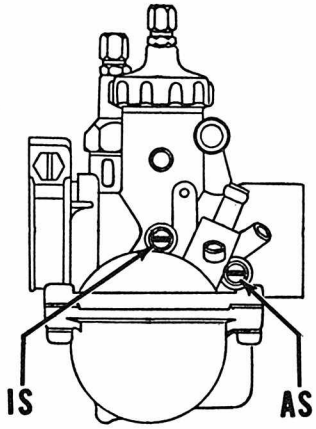


Fig. S1-1—View of carburetor left side showing air bleed adjusting screw (AS) and idle speed adjusting screw (IS). All models are similar.

Clip (2) in third groove from top of needle (3).
Float setting
(H—Fig. S1-1A) .....$\frac{29}{32}$ inch
Idle mixture needle
(AS—Fig. S1-1) ....1¾ turns open

M31 Model

Carburetor type VM15SC
Main jet (5—Fig. S1-2) 120
Needle jet (4) E-0
Clip (2) in third groove from top of needle (3).
Float setting
(H—Fig. S1-1A) .....$\frac{29}{32}$ inch
Idle mixture needle
(AS—Fig. S1-1) .....1 turn open

K10, K11 and K15 Models

Carburetor type VM17SC
Main jet (5—Fig. S1-2)—
K10 65-70
K11 60
K15 70
Needle jet (4)—
K10 0-0
K11 .....N-6
K15 0-0

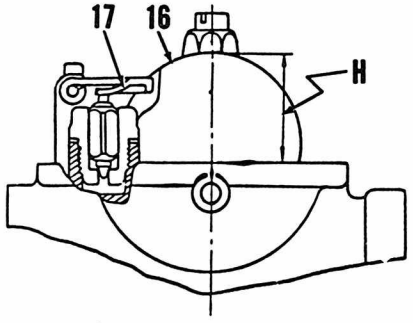


Fig. S1-1A—Float level (H) is adjusted by bending tang (17).

Clip (2) in second groove from top of needle (3) on K10 and K15 models, third groove from top on K11.
Float setting
(H—Fig. S1-1A) .....⅞ inch
Idle mixture needle (AS—Fig. S1-1) ¾ turn open for K15, 1¼-1½ turns open for K10 and K11.

K10P, K11P and K15P Models (flange mounted)

Carburetor type VM20SH
Main jet (5—Fig. S1-2)—
K10P and K15P 110
K11P 95
Needle jet (4) N-6
Clip (2) in third groove from top of needle (3) on K11P and K15P, fourth groove from top on K15P models.

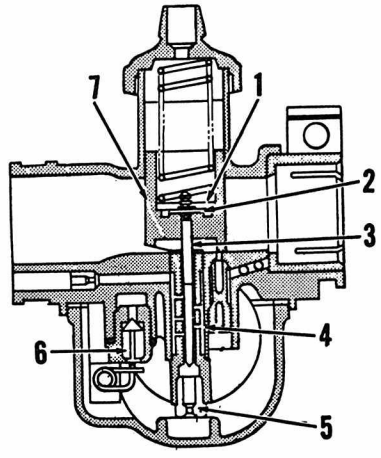


Fig. S1-2—Cross section of carburetor showing various points of adjustment.

1. Washer
2. Clip
3. Needle valve
4. Needle valve jet
5. Main jet
6. Float valve
7. Throttle slide

Fig. S1-3—Ignition timing marks on some models are on crankcase and flywheel as shown at left. Late models are on crankcase left cover and flywheel as shown at right.

Float setting
(H—Fig. S1-1A) .....$\frac{15}{16}$ inch
Idle mixture needle (AS—Fig. S1-1) 1¼-1½ turns open.

IGNITION AND ELECTRICAL. An energy transfer type ignition is used. The ignition primary coil, lighting coil, ignition points and condenser are located on the stator plate on left side of engine under the flywheel. Ignition points should be set to 0.35 MM (0.014 in.) fully open. Ignition should occur (points should just open) when timing marks are aligned as shown in Fig. S1-3. Small timing adjustment can be made by varying point gap between 0.3-0.4 MM (0.012-0.016 in.); however, the coil stator plate can be moved in the three elongated mounting holes after removing the flywheel.

M 15 D models are equipped with a starter dynamo and a 12 volt battery. Breaker points are mounted on the stator housing. Point gap should be 0.012-0.016 inch (0.3-0.4 MM). Points should just open as mark on point cam aligns with timing pointer mounted on base plate.

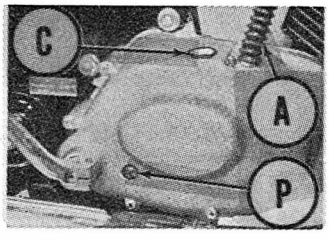


Fig. S1-5—View of right side showing location of gear box oil filler cap (C), oil level plug (P) and clutch adjuster (A).

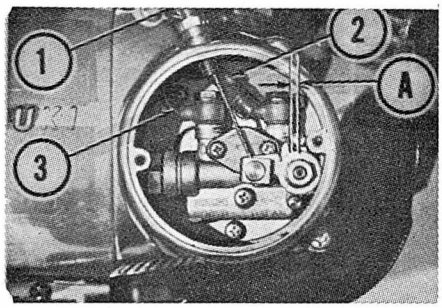


Fig. S1-6—When the throttle is wide open clearance (A) should be 0.04 inch (1MM) between control lever and stop pin. Oil inlet line is shown at (2), oil pressure line at (3) and cable guide at (1).

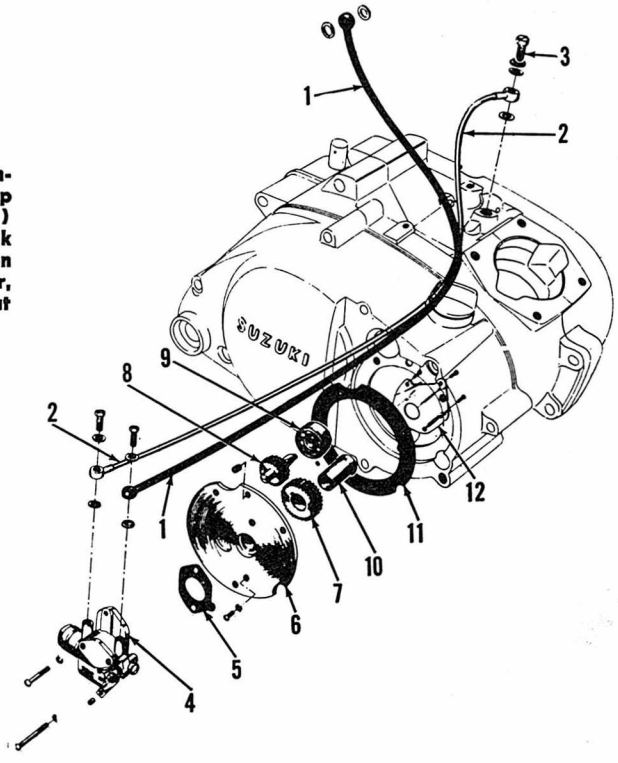


Fig. S1-7—View of the engine oil injection system. Top end of the inlet oil line (1) connects to the oil tank filter. Gaskets are used on all banjo fittings; however, "O" ring is also used at check valve (3).

1. Inlet oil line
2. Pressure line
3. Check valve
4. Oil pump
5. Gasket
6. Drive housing
7. Pump gear
8. Drive gear
9. Bearing
10. Pump drive shaft
11. Gasket
12. Cover plate

LUBRICATION. On all models except K10P, K11P and K15P the engine is lubricated by mixing two stroke motor oil with premium gasoline. Ratio should be 1:15 for the first 1000 miles; 1:20 after 1000 miles.

An oil injection pump is used on K10P, K11P and K15P models which automatically pumps and meters the oil. The oil is delivered to the crankshaft left main bearing and the connecting rod lower bearing. Refer to the "POSI-FORCE" OIL INJECTION paragraphs for adjustment and repair.

On all models, the gear box is normally lubricated with SAE 30 or 40 motor oil; however, in cold weather SAE 20W/40 multigrade engine oil is recommended. Gear box oil should be maintained at level of plug (P—Fig. S1-5). Gear box oil should be drained and refilled every 2000 miles.

"POSI-FORCE" OIL INJECTION. The oil injection system automatically meters and pumps oil from a separate tank to the left main bearing and connecting rod lower bearing. The oil tank should be filled with two stroke motor oil and should **never** be allowed to run dry. The oil pump and metering unit is mounted on the right side cover plate as shown in Fig. S1-6. The oil pump drive gears (7 & 8—Fig. S1-7) are lubricated by oil in the gear box and clutch. If the system is drained or pump unit is renewed, all oil lines should be filled before starting engine. Start engine and run at idle while pulling pump control cable (inside guide 1—Fig. S1-6) up. Release cable after exhaust begins to smoke excessively. If air bubbles are always in oil lines, check for air leak in lines or at large plug on rear of pump.

The pump control cable adjustment should be checked every 1000 miles. If cable is incorrectly adjusted, engine may be damaged. To check, twist throttle hand lever to maximum speed position and check clearance (A—Fig. S1-6) between pump control lever and stop. If clearance is not 0.04 inch (1MM), loosen the lock nut and turn the pump control cable guide (1—Fig. S1-6) until clearance is correct. Both oil line union bolts on pump should be tightened to 20 inch-pounds torque. The check valve (3—Fig. S1-7) should be tightened to 35 inch pounds torque.

CLUTCH CONTROLS. There is no external adjustment on the automatic clutch used on **M31** models. Refer to the repairs section for overhaul and internal adjustment procedures.

The clutch on **M12 and M15** models should be adjusted at the cable adjuster on clutch cover (left side) to provide clutch lever with 4 MM (0.16 in.) free play as shown at A—Fig. S1-10.

The clutch on **K10, K11 and K15** models is provided with two points of adjustment as shown in Fig. S1-11. The free play as shown at A—Fig. S1-10 should be 4 MM (0.16 in.) and can normally be adjusted at the cable adjuster. If adjuster is screwed nearly

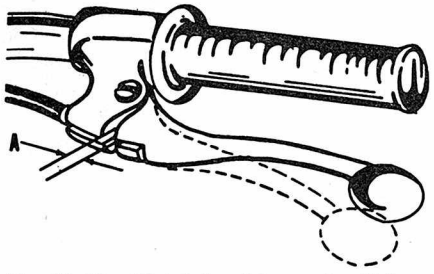


Fig. S1-10—Clutch hand lever should have 4 MM (0.16 in.) free play at A. Refer to text for adjustment procedure.

out of cover, additional adjustment is provided at the adjusting screw.

SUSPENSION. Each front suspension unit on 80 cc models contains 125 cc (0.26 pint) of SAE 30 engine oil. Drain plug is shown in Fig. S1-12 and refilling plug in Fig. S1-14. Each unit must have the same amount of oil or erratic handling may occur.

Shock absorbers for all rear suspension units and front units for model M15 and M 31 are not repairable and must be renewed if leaking or damaged. Refer to Fig. S1-16 for typical cross sectional views.

Fig. S1-11—View of 80 cc left side showing points of clutch adjustment.

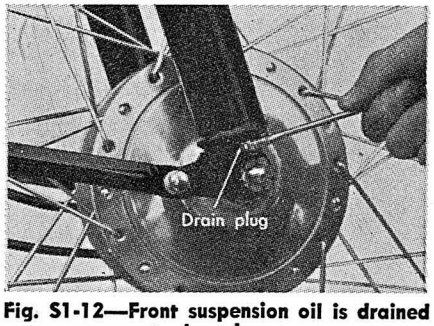


Fig. S1-12—Front suspension oil is drained at plug shown.

Fig. S1-14—Front suspension oil is refilled at front fork bolt shown.

REPAIRS

PISTON, RINGS AND CYLINDER. The piston can be removed after removing exhaust pipe, carburetor, cylinder head and cylinder. Standard cylinder bore diameter is 41.0 MM (1.6142 in.) for 50cc models, 43 MM (1.6929 in.) for 55cc, 45 MM (1.7717 in.) for 80cc models. Refer to the following specifications.

Ring end gap
(50 cc) .....0.1-0.2 MM
0.004-0.008 in.
(55 & 80 cc) .....0.1-0.25 MM
0.004-0.012 in.
wear limit .....1.0 MM
0.039 in.

Ring groove clearance
(all models) .....0.020-0.055 MM
0.0008-0.0022 in.
wear limit .....0.15 MM
0.006 in.

Piston skirt clearance
(50 cc) .....0.023-0.048 MM
0.0009-0.002 in.
wear limit .....0.15 MM
0.006 in.

Piston skirt clearance
(55 cc) .....0.089-0.099 MM
0.0035-0.0039 in.
wear limit .....0.2 MM
0.008 in.

Piston skirt clearance
(K10, K11 & K15) ....0.082-0.097 MM
0.0032-0.0038 in.
wear limit .....0.2 MM
0.008 in.

Piston skirt clearance
(K10P, K11P &
K15P) .....0.035-0.040 MM
0.0014-0.0016 in.
wear limit .....0.11 MM
0.0045 in.

Piston pin clearance in piston
(50 cc) .....0.002-0.014 MM
0.00008-0.00055 in.
(55 cc) minus 0.010-plus 0.006 MM
minus 0.00039-plus 0.0023 in.
(80 cc) minus 0.009-plus 0.003 MM
minus 0.00035-plus 0.00012 in.

Piston skirt clearance in cylinder bore should be measured by measuring piston skirt diameter at right angles to piston pin and cylinder bore diameter, then subtracting. Chrome plated piston ring should be installed in top groove. Rings with stamped marks "RIK" or "STD" should be installed with marks toward top of piston. Piston must be installed with arrow on top aimed toward exhaust port. Oversize pistons and rings are available. Cylinder and head retaining nuts should be tightened in a criss-cross pattern to a torque of 70-100 in. lbs.

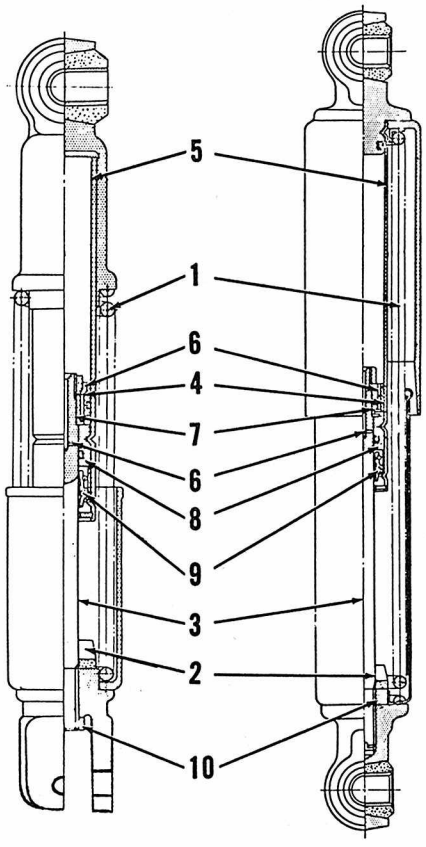


Fig. S1-16—Cross sectional view of unitized suspension units. Unit on left is used on front of M15 and M31, unit on right is typical of all rear units.

1. Spring
2. Rubber damper
3. Rod
4. Piston
5. Cylinder
6. Oil channels
7. One-way valve
8. Bearing
9. Oil seal
10. Nut

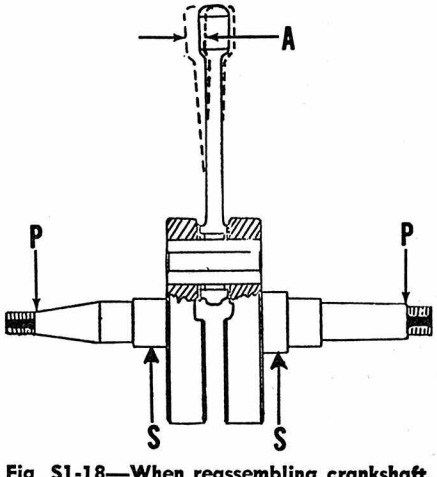


Fig. S1-18—When reassembling crankshaft, alignment should be checked. Crankshaft should be supported at points (S) near counterweights. Eccentricity measured with a dial indicator is at (P). Side play of rod small end (A) determines crankpin clearance.

CONNECTING ROD AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Connecting rod, crankpin and roller bearings are removed by pressing crankshaft apart. Crankshaft should

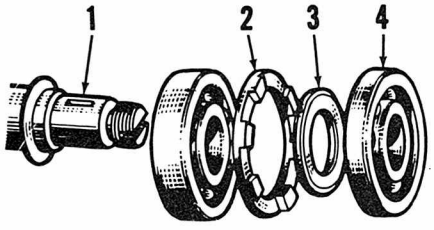


Fig. S1-19—Right crankshaft spacer (2) should be installed as shown with lugs toward bearing (4).

1. Right end of crankshaft
2. Spacer
3. Inner spacer
4. Ball bearing

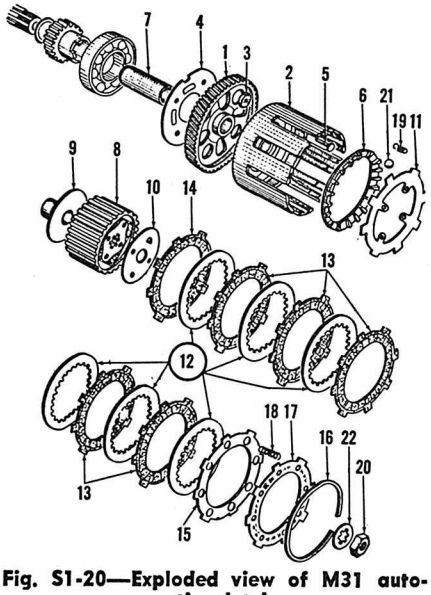


Fig. S1-20—Exploded view of M31 automatic clutch.

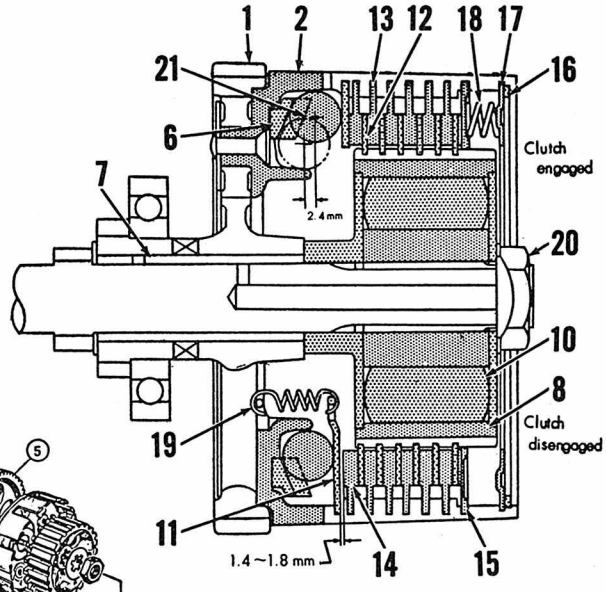
1. Driven gear
2. Clutch housing
3. Shock damper
4. Plate
5. Rivet
6. Ball guide ring
7. Spacer
8. Hub
9. Spacer
10. Hub retainer
11. Inner plate
12. Steel plates
13. Friction plates (5 used)
14. Inner friction plate (1 used)
15. Outer friction plate (1 used)
16. Snap ring
17. Outer plate
18. Clutch spring (8 used)
19. Inner plate return spring (4 used)
20. Nut
21. Steel balls (18 used)

be disassembled **ONLY** if required tools are available to correctly check and align the reassembled crankshaft. Maximum eccentricity allowed when checked at points (P—Fig. S1-18) should be less than 0.04 MM (0.00158 in.). Axial play of connecting rod small end (A) should be less than 4 MM (0.1575 in.).

CLUTCH (M31). The automatic clutch used on M31 models has no external adjustment. To remove or adjust, first remove the kick starter and right side crankcase (clutch) cover. Check clearance between inner plate (11—Fig. S1-21) and inner friction plate (14) with a feeler gage from slots in clutch housing (2). If clearance is not 1.4-1.8 MM (0.05512-0.07087 in.) repair and/or adjustment is required. To remove clutch, remove nut (20—Fig. S1-20) and snap ring (16). New friction plates (13) are 3.0 MM (0.1181 in.) thick and should be replaced if less than 2.85 MM (0.1122 in.). New inner friction plate (14) is 3.7 MM (0.1457 in.) and should be replaced if less than 3.55 MM (0.1398 in). Free length of new clutch springs (18) is 18.8 MM (0.7402 in.) and should be replaced if less than 17.8 MM (0.7008 in.). Free length of new inner plate return springs (19) is 17.1 MM (0.6832 in.) and should be replaced if more than 17.6 MM (0.6929 in.).

When reassembling, make certain inner friction plate (14) is correctly installed. Inner plate can be identified by thickness and notch cut into one of the driving lugs. Assemble in order shown in Fig. S1-20 and install on transmission shaft. Measure clearance between inner plate (11—Fig. S1-21) and inner friction plate (14) with feeler gage. If clearance is not 1.4-1.8 MM (0.05512-0.07087 in.), record the clearance and disassemble clutch. Measure thickness of steel plates (12—Fig. S20) and change the combined height of the steel plates to obtain the correct clearance. Steel plates are available in thicknesses of 1.6 MM (0.06299 in.) and 1.2 MM (0.04724 in.). Two steel plates can be installed between friction plates as required to obtain the correct clearance. Nut (20) should be torqued to 180-265 in. lbs. and secured with tab washer (22).

Fig. S1-21 — Cross sectional view of M31 clutch assembly. Clearance of 1.4-1.8 MM is measured with feeler gage when clutch is disengaged.



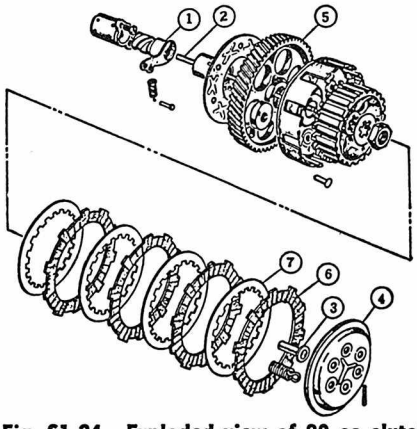


Fig. S1-24—Exploded view of 80 cc clutch assembly. Refer to Fig. S1-34 for installation drawing.

1. Clutch cam
2. Rod
3. Rod tip
4. Pressure plate
5. Driven gear
6. Clutch facing (4 used on early models 5 on late models)
7. Driven plate (4 used on early models 5 on late models)

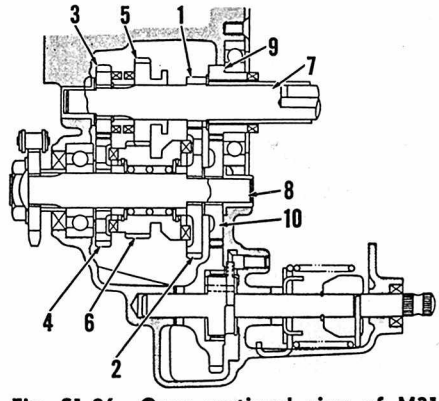


Fig. S1-26—Cross sectional view of M31 three speed transmission.

CLUTCH (80cc Models). The manual, multiple disc, wet type clutch is mounted on the right end of the transmission input shaft. The clutch is actuated by a cam on the left side cover and a rod which goes through the input shaft. Four clutch facings (6—Fig. S1-24) and four driven plates (7) are used on K10, K11 and K15 models. On K10P, K11P and K15P models, five facings and five plates are used. Refer to the following specifications.

Driven plate thickness .....1.6 MM
0.063 in.
warpage limit .....0.1 MM
0.0039 in.
Clutch facing thickness ..2.9-3.1 MM
0.114-0.121 in.
warpage limit .....0.4 MM
0.0157 in.

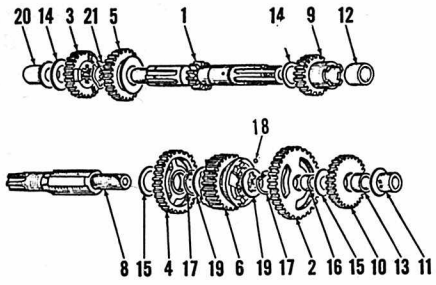


Fig. S1-28—Exploded view of M31 three speed transmission. Bushing (11) has an open end, bushing (20) has a closed end.

1. Low gear pinion
2. Low gear
3. Second gear pinion
4. Second gear
5. Third gear pinion
6. Third gear
7. Transmission input shaft
8. Output shaft
9. Starter gear
10. Starter idler gear
11. Bushing
12. Starter gear bushing
13. Idler gear bushing
14. Thrust washer
15. Thrust washer
16. Low gear bushing
17. Third gear snap rings
18. Third gear ball bearings (18 used)
19. Third gear washers
20. Bushing
21. Second gear snap ring

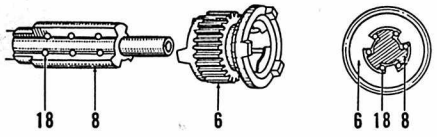


Fig. S1-30—The 18 steel balls should be installed between output shaft and third gear as shown.

Spring free length—
K10, K11 & K15 .....21 MM
0.825 in.
K10P, K11P & K15P .....31 MM
1.23 in.

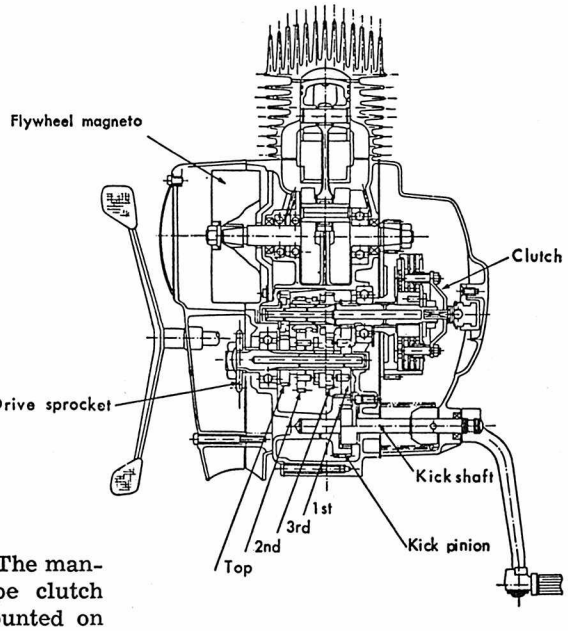


Fig. S1-32 — Cross sectional view of 50 cc engine and transmission.

CLUTCH (M12 and M15). The manual, multiple disc, wet type clutch used on these models is mounted on the right end of the transmission input shaft as shown in Fig. S1-32. Specifications are as follows:

Clutch disc thickness .....2.3 MM
0.09 in.
wear limit .....1.9 MM
0.075 in.
Driven plates (3 used)
thickness .....1.6 MM
0.6288 in.
Clutch facings (4 used)
thickness .....2.8-3.2 MM
0.11004-0.12576 in.
wear limit .....2.5 MM
0.09825 in.
Warpage limit of disc, facings and plates .....0.1 MM Maximum
0.0039 in. Maximum
Clutch spring free length (6 used) .....19 MM
0.7462 in.
wear limit .....18 MM
0.7074 in.

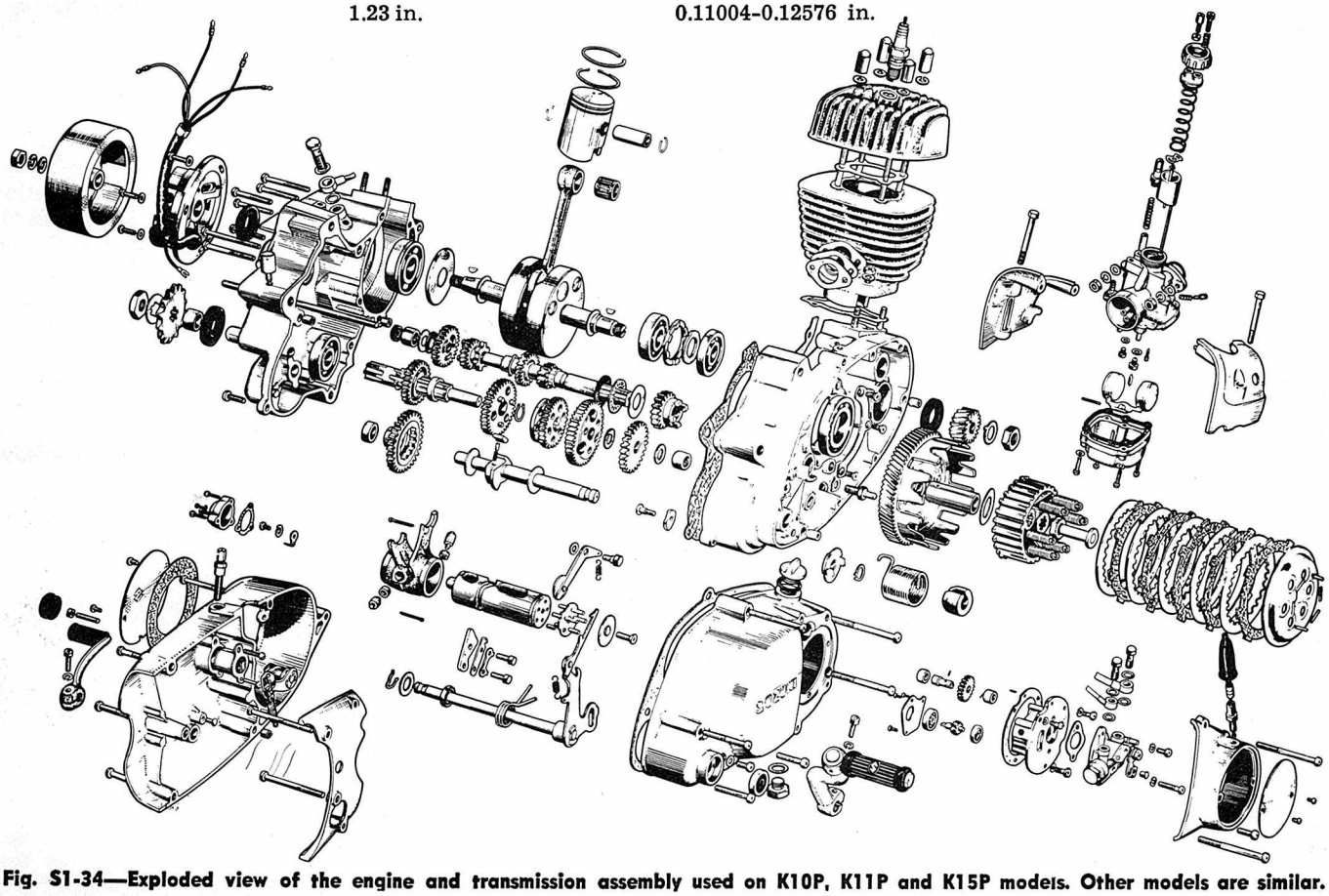


Fig. S1-34—Exploded view of the engine and transmission assembly used on K10P, K11P and K15P models. Other models are similar.

CRANKCASE AND GEAR BOX. To disassemble the crankcase and gear box, the engine must first be removed. Remove the cylinder head, cylinder, piston, flywheel, magneto, clutch cover and clutch. Remove the screws that hold crankcase halves together and carefully separate the halves. Be careful not to damage sealing surfaces of crankcase. Refer to Figs. S1-24, S1-26, S1-28, S1-30, S1-32 and S1-34.

SUZUKI 100CC MODELS (ROTARY VALVE)

MODEL	A100 Charger & AS100 Sierra	AC 100 Wolf
Displacement-cc	98	98
Bore-MM	50	50
Stroke-MM	50	50
Number of cylinders	1	1
Engine oiling	Oil pump	Oil Pump
Plug gap-inch	0.020-0.024	0.020-0.024
Point gap-inch	0.014	0.014
Ignition timing	Fixed	Fixed
Degrees BTDC	20	20
Electrical system voltage	6	6
Tire size-Front	2.50x17	2.50x18
Rear	2.50x17	2.75x18
Tire pressure-front	22	22
Rear	29*	22*
Rear chain free play-inch	¾	¾
Number of speeds	4	4
Weight-lbs. (Approx.)	176	184

*Increase rear tire pressure to 34 psi when carrying passenger.

MAINTENANCE

SPARK PLUG. Recommended spark plug is NGK type B-77HC or Champion L-5. Electrode gap is 0.020-0.024 inch.

CARBURETOR. A Mikuni VM 20SC carburetor is located on the right side of the engine. Initial setting for the idle mixture needle (11—Fig. S2-1) is 1½ turns out. Turning the idle mixture needle out leans the mixture. Idle speed is changed by turning adjuster (2). Standard size of main jet (9) is #75 and pilot jet (14) is #35. Clip (5) should be installed in second groove from top of needle (6). Float height (H—Fig. S2-2) should be 0.98-inch.

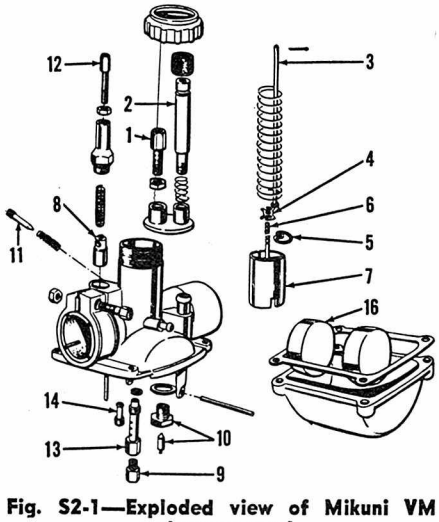


Fig. S2-1—Exploded view of Mikuni VM carburetor used.

1. Throttle cable guide
2. Idle speed adjuster
3. Idle speed rod
4. Retainer
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Fuel inlet valve
11. Idle mixture needle
12. Starting valve cable guide
13. Needle jet
14. Pilot jet
16. Float

IGNITION AND ELECTRICAL. An energy transfer type ignition is used. The ignition primary coil, condenser and breaker points are located under the flywheel. The high tension coil is located inside the frame under the fuel tank. Ignition breaker point gap should be set to 0.014 inch fully open. Ignition should occur (points just open) when the timing marks (TM—Fig. S2-4) are aligned. To change the ignition timing, it is necessary to remove the left side cover and the flywheel, then loosen the three retaining screws and move the stator plate. Small adjustments in ignition timing can be accomplished by varying the breaker point gap within the limits of 0.012-0.016 inch. Flywheel nut should be torqued to 25-33 Ft.-Lbs.

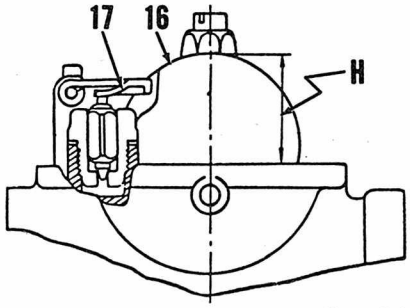


Fig. S2-2—Float level (H) is adjusted by bending tang (17). Make certain that both floats are the same.

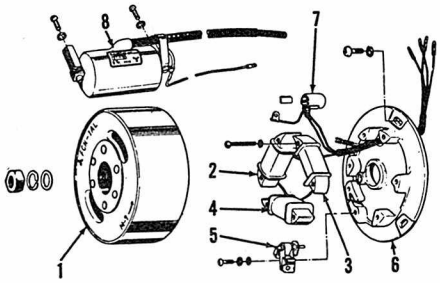


Fig. S2-3—Exploded view of the ignition and electrical system flywheel assembly. Ignition coil (8) is located inside frame under the fuel tank.

1. Flywheel
2. Lighting coil
3. Lighting coil
4. Ignition primary coil
5. Breaker points
6. Stator plate
7. Condenser
8. Ignition coil

LUBRICATION. The oil injection system automatically meters and pumps oil from a separate tank to the left main bearings, connecting rod lower bearing and the rotary valve. After the oil lubricates these parts it is carried as a mist to lubricate the other engine parts. The oil tank should **never** be allowed to run dry.

Keep tank filled with a good quality two-stroke oil. The oil pump and metering unit is mounted on the left side of crankcase and is driven by the kick starter gear which is rotating whenever engine is running regardless of clutch position. If the oil system is drained or pump unit is renewed, all oil lines should be filled before starting engine. Start engine and run at idle speed while pulling pump control cable (in guide at rear left side of crankcase) up. Release cable after exhaust begins to smoke excessively. If air bubbles are always

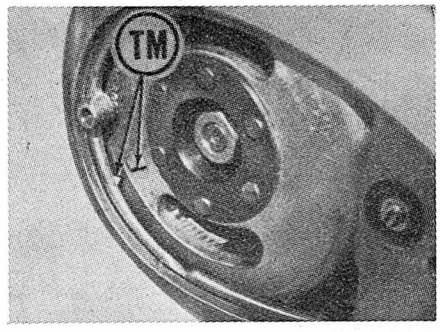


Fig. S2-4 — View of the ignition timing marks. The breaker points should just open when the marks align.

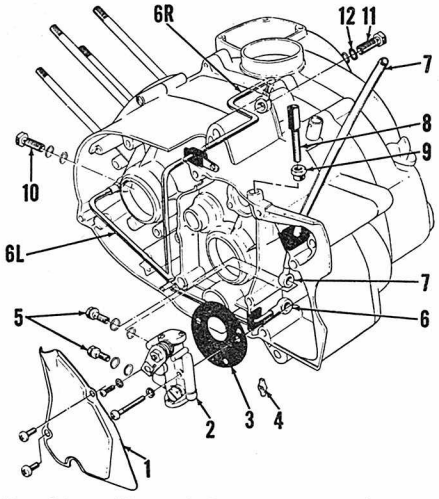


Fig. S2-5—View of the engine oil injection system. Top end of the inlet oil line (7) connects to the oil tank filter. Gaskets are used on both sides of all banjo fittings; however, "O" ring (12) is also used at check valve (11).

1. Pump cover
2. Oil pump
3. Gasket
4. Pump drive adapter
5. Oil line union bolts
6. 6L & 6R. Oil pressure line
7. Inlet oil line
8. Cable guide
9. Lock nut
10. Union bolt
11. Check valve
12. "O" ring

in the oil lines, check for air leak in lines.

The pump control cable adjustment should be checked every 1000 miles. If cable is incorrectly adjusted, the engine may be damaged. To adjust, remove the engine left side cover, disconnect drive chain and remove cover (1—Fig. S2-5). Twist the throttle to full open (maximum speed) position then check the hole (H—Fig. S2-6) in lever and the mark. If the mark is not centered in hole (H), loosen the lock nut and turn the cable guide (G—Fig. S2-7).

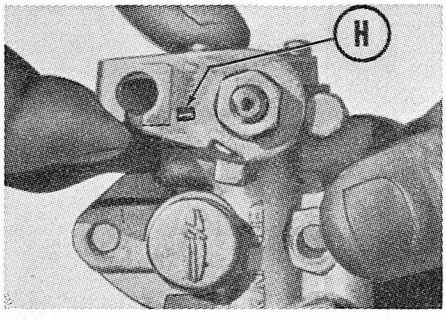


Fig. S2-6—View of the oil pump adjustment hole aligned with the mark on pump body. Hole should align with mark when the throttle is in maximum speed position.

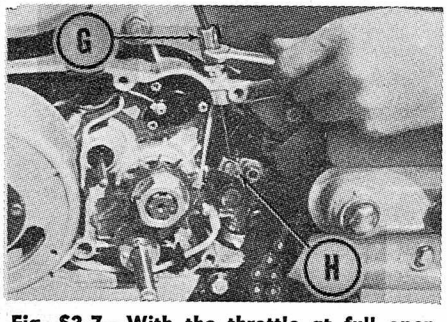


Fig. S2-7—With the throttle at full open, turn cable guide (G) until hole (H) in lever is aligned with mark on pump body.

If pump is removed, make sure that drive adapter (4—Fig. S2-5) is installed. Oil pump mounting screws should be torqued to 24-43 inch-pounds. Union bolts (5 & 10—Fig. S2-5) should be torqued to 17-24 inch-pounds and check valve (11) should be torqued to 24-43 inch-pounds.

CLUTCH CONTROLS. To adjust the clutch, remove the plate from the engine left side cover. Loosen the lock nut and turn adjusting screw (S—Fig. S2-8) IN until slight resistance is felt then back screw out ½-turn and tighten lock nut. Adjust the cable guide (G) until the clutch hand lever has 0.12 inch free play at A—Fig. S2-9.

SUSPENSION. Each front suspension unit contains 125cc (0.26 pint) of SAE 30 motor oil. Oil is drained at screw on bottom of each unit and filled at the screw in top. Each unit must have the same amount of oil or erratic handling may occur. Rear shock absorbers are not repairable and must be renewed if bent, leaking or otherwise damaged.

REPAIRS

PISTON, RINGS AND CYLINDER. The piston can be removed after removing exhaust pipe, cylinder head and cylinder. Standard cylinder bore nominal diameter is 50.1MM (1.998 inch). Pistons and rings are available in standard size and two oversizes. Cylinder bore taper should not exceed 0.002 inch and out of round should not exceed 0.0004 inch. Piston to cylinder clearance should be 0.0020-0.0024 inch (0.05-0.06MM) when fitting new piston. Wear limit is 0.0043 inch between piston and cylinder. Piston ring end gap should be 0.0059-0.0138 inch (0.15-0.35MM).

When reassembling, install ring expander and the bright piston ring in lower groove. The mark "2R" should

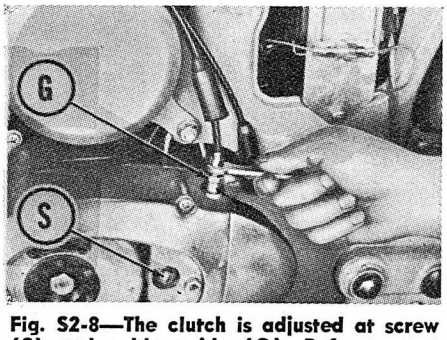


Fig. S2-8—The clutch is adjusted at screw (S) and cable guide (G). Refer to text for procedure.

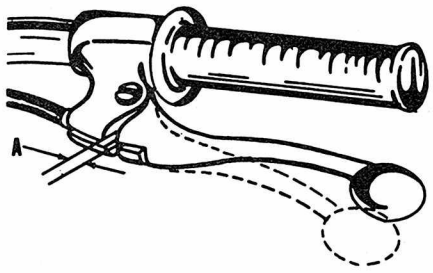


Fig. S2-9—The clutch hand lever should have 0.12 inch free play at (A).

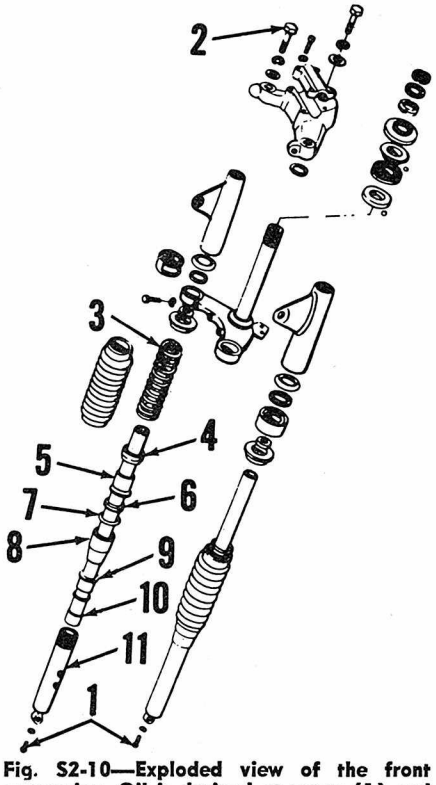


Fig. S2-10—Exploded view of the front suspension. Oil is drained at screw (1) and filled at screw (2).

1. Drain plug
2. Filler screw
3. Spring
4. Spring guide
5. Dust seal
6. Oil seal
7. "O" ring
8. Seal housing
9. Bushing
10. Inner tube
11. Lower tube

be toward top. Install the dark colored ring in top groove with "1R" on side of ring toward top of piston. Install piston on connecting rod with arrow pointing toward the front of engine. When installing cylinder, make certain that both piston rings and the expander are positioned correctly around the pins in grooves. Install composition (copper/asbestos) head gaskets with bead next to cylinder head. Tighten the four cylinder head retaining nuts alternately to 156-204 inch pounds torque.

CONNECTING ROD AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Connecting rod and crankpin are removed by pressing the crankshaft apart. Crankshaft should be disassembled **ONLY** if required tools are

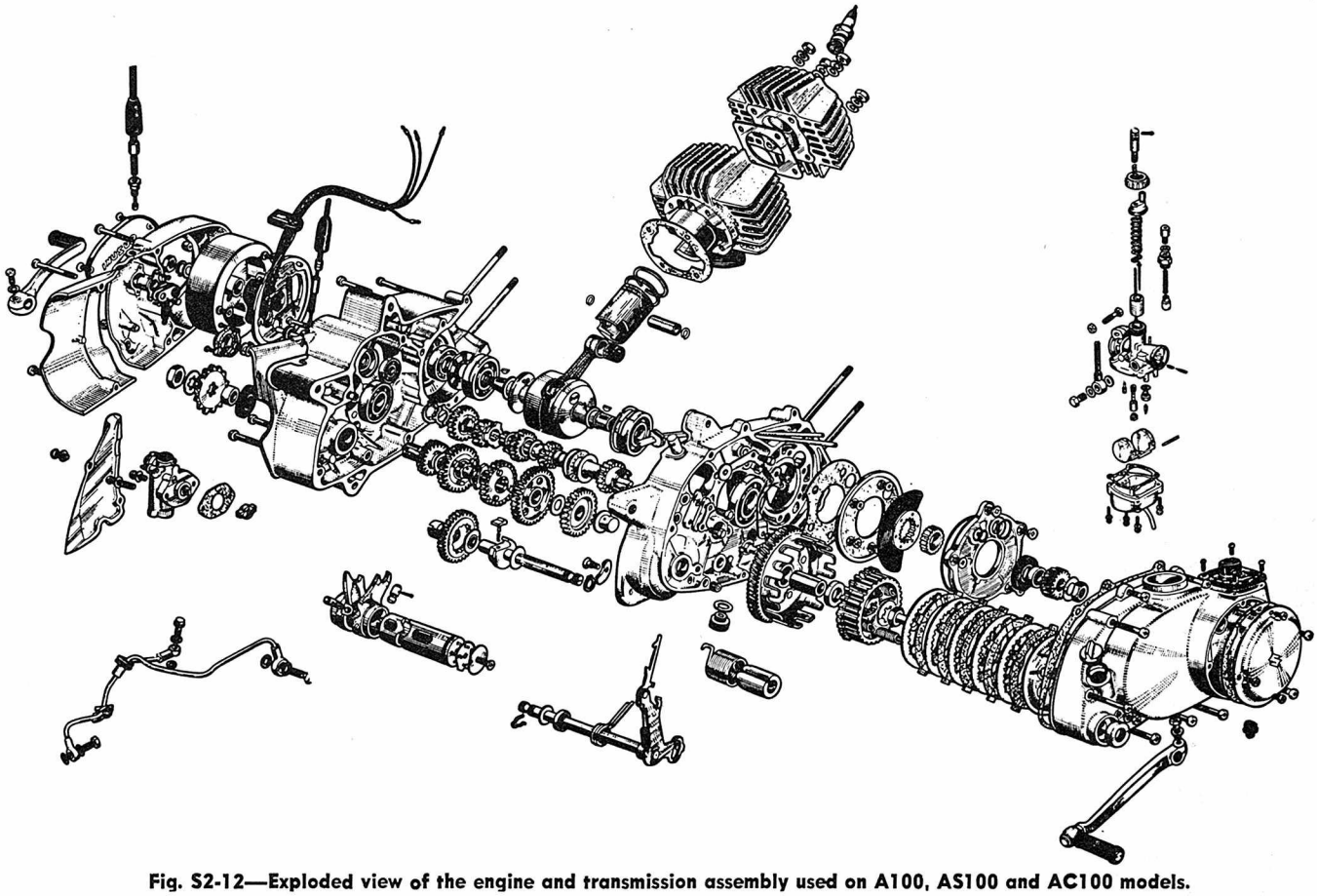


Fig. S2-12—Exploded view of the engine and transmission assembly used on A100, AS100 and AC100 models.

available to correctly check and align the reassembled crankshaft. Maximum eccentricity allowed at ends when supported at main bearings is 0.002 inch. Side clearance of connecting rod at lower end should be 0.0073-0.0277 inch (0.185-0.57MM). If side play (shake) at piston pin end of connecting rod exceeds 0.12 inch (3MM); the connecting rod, lower bearing and crankpin should be renewed.

Main bearings should be tight fit on crankshaft and in crankcase. When installing bearings, crankcase should be heated. Notches on spacer (3—Fig. S2-14) should be toward inside bearing (4). Open side of seal (23) should be toward inside and small sharp lip of seal should be toward gear (24). Be careful not to damage or roll the small lip over if spacer (20) is installed from outside.

CLUTCH. To remove the clutch, remove carburetor, air cleaner, kick starter pedal and the engine right side cover. Be sure to disconnect the oil injection tube (6R—Fig. S2-5) before removing cover.

Use a wire to pull the ends of springs (2—Fig. S2-15) out, then remove pins (1). After all pins (1) are removed, pressure plate (3), release plunger (4), friction discs (5) and driven plates (6) can be withdrawn. The clutch hub (9) and drum (11) can be removed after removing nut (7). Refer to the following specification data:

Spacer (12) diameter . 0.8252-0.8260 in.
Wear limit . . . . . 0.8190 in.

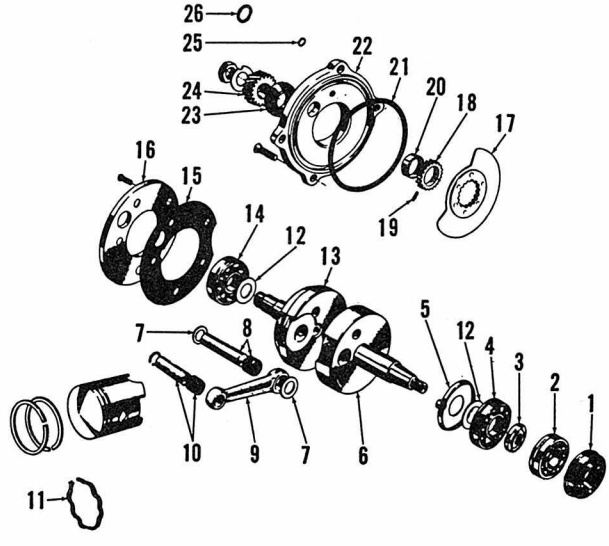


Fig. S2-14 — Exploded view of the crankshaft and rotary valve.

1. Seal
2. Main bearing
3. Spacer
4. Main bearing
5. Oil guide plate
6. Crankshaft left end
7. Thrust washer
8. Crankpin and bearing
9. Connecting rod
10. Piston pin and bearing
11. Expander
12. Thrust washer
13. Crankshaft right end
14. Main bearing
15. Gasket
16. Valve seat
17. Rotary valve
18. Rotary valve guide
19. Guide drive pin
20. Spacer
21. "O" ring
22. Valve cover plate
23. Oil seal
24. Crankshaft gear
25. Oil injection "O" ring
26. Carburetor "O" ring

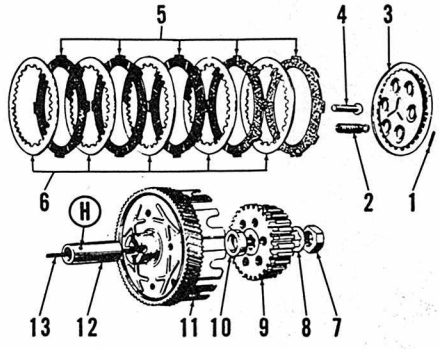


Fig. S2-15—Exploded view of the clutch assembly. Hole (H) should be toward inside, as shown, when installing spacer (12).

1. Spring pin (6 used)
2. Springs (6 used)
3. Pressure plate
4. Release plunger
5. Friction discs (5 used)
6. Driven plates (5 used)
7. Nut
8. Lock (tab) washer
9. Clutch hub
10. Spacer
11. Clutch drum
12. Spacer
13. Release rod

Friction disc (5)
thickness .....0.114-0.122 in.
Wear limit .....0.110 in.
Springs (2) free length .....1.295 in.
Stretch limit .....1.343 in.

Side play of clutch drum (11) should be 0.0039-0.0098 inch. If side play exceeds 0.0118 inch, spacer (12) can be shortened slightly by grinding on an oil stone. Backlash between crankshaft gear (24—Fig. S2-14) and primary drive on clutch drum (11—Fig. S2-15) should be 0.0018 inch. Renew gears if backlash exceeds 0.0039 inch.

When reassembling, hole (H) in the spacer (12) should be toward inside as shown. Springs (2) should be threaded into clutch hub (9) until the springs are flush with back (inside) surface of hub. Make sure that marks (M—Fig. S2-16) are aligned when pressure plate is installed.

CRANKCASE AND GEAR BOX. To disassemble the crankcase and transmission, the engine must first be removed. Remove the cylinder head, cylinder, piston, engine side covers, clutch, flywheel, ignition and electrical system stator assembly, output sprocket, oil injection pump, crankshaft gear, rotary valve cover plate, rotary valve and valve guide sleeve. Remove the kick starter return spring and spring guide. Remove the shift linkage and shift drum detent. Remove the 10 screws that attach crankcase halves together, then carefully separate the halves. Shafts should remain in the right half when separating (Fig. S2-17).

Clearance between shifter forks (11 & 12—Fig. S2-18) and grooves in gears (22 & 32) should be 0.008-0.016 inch. If clearance exceeds 0.032 inch, renew fork and/or gear. When renewing bushing (28), make sure that oil holes are in open top part of right crankcase. Crankcase halves should be heated when removing and installing bearings. Oil seal (38) should be installed with open face toward inside. Be careful not to damage or roll the small sharp outside lip on seal (38) when installing the spacer (39). When installing the positioning pieces (24) and snap ring (25) on gear (23), refer to Fig. S2-19. The opening in snap ring should NOT be aligned with split in the positioning pieces.

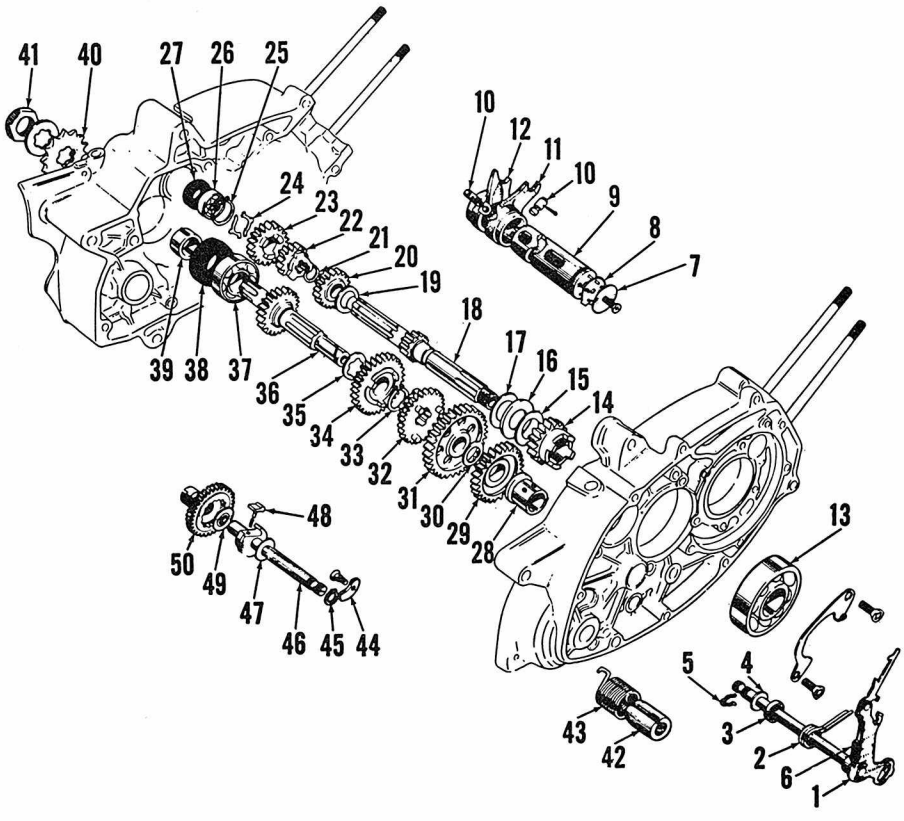


Fig. S2-18—Exploded view of the transmission and kick starter assembly.

1. Shift linkage
2. Return spring
3. Oil seal
4. Thrust washer
5. Snap ring
6. Shift ratchet spring
7. Pin retainer
8. Side plate
9. Shift drum
10. Guide pins
11. Shift fork (1st & 2nd)
12. Shift fork (3rd & 4th)
13. Bearing
14. Kick starter gear
15. Thrust washer (30MM)
16. Needle thrust bearing
17. Thrust washer (34.5MM)
18. Input shaft
19. Thrust washer (23MM)
20. Gear (3rd)
21. Snap ring
22. Sliding gear (2nd)
23. Gear (4th)
24. Positioning pieces
25. Snap ring
26. Bearing
27. Push rod oil seal
28. Bushing
29. Kick starter idler
30. Thrust washer
31. Gear (1st)
32. Sliding gear (3rd)
33. Snap ring
34. Gear (2nd)
35. Thrust washer (27MM)
36. Output sprocket
37. Bearing
38. Oil seal
39. Spacer
40. Sprocket
41. Nut
42. Spring guide
43. Kick starter return spring
44. Stop
45. Snap ring
46. Kick starter shaft
47. Thrust washer (I.D. 16MM)
48. Ratchet assembly
49. Thrust washer (I.D. 12MM)
50. Kick starter gear

SPEED TUNING

Suzuki's A100 R-T Kit may be installed on A100, AS100 and AC100 models to improve performance of these 100cc singles. The following specifications and recommendations are from the A100 R-T Kit. Any modification of standard parts or installation of performance parts will void any warranty.

SPARK PLUG AND IGNITION. Recommended spark plug for a competition prepared model is NGK type B-8EN or a B-9EN.

A special racing magneto is available and is recommended for operation above 10,000 RPM. Ignition should occur at 21 degrees BTDC. Piston will be 0.078 inch BTDC at this point.

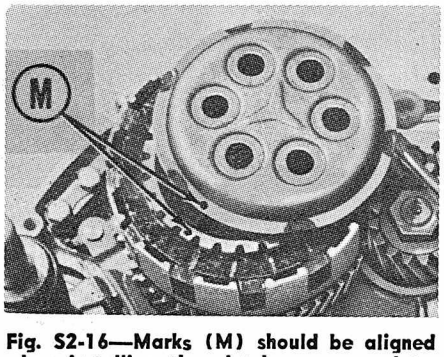


Fig. S2-16—Marks (M) should be aligned when installing the clutch pressure plate.

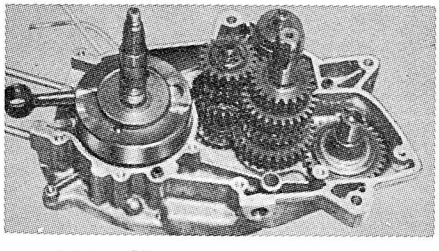


Fig. S2-17—View of the right crankcase half with gears and shafts positioned.

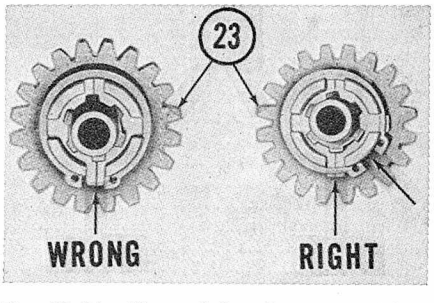


Fig. S2-19—View of fourth gear positioning pieces and snap ring (23, 24 & 25—Fig. S2-18) assembled. Split in positioning pieces and opening in snap ring should not be aligned.

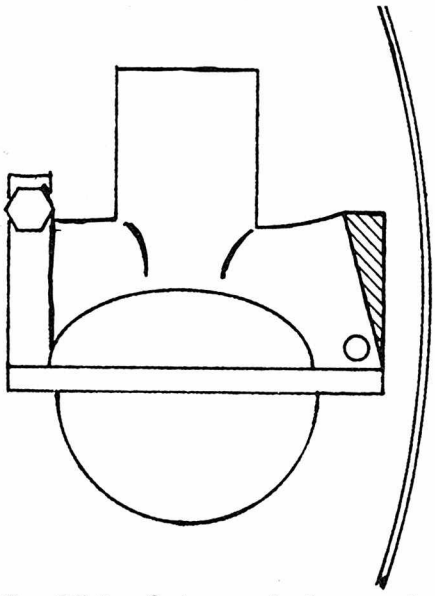


Fig. ST2-1 — Carburetor intake may be trimmed as shown by shaded area to improve air flow.

Use of the ignition coil from a TM250 is recommended. The standard resistor type spark plug cap should be replaced with a non-suppressor type cap.

INDUCTION SYSTEM. A Mikuni sliding valve 22 MM unit is used in the Kit. The following jet sizes are standard:

Main jet .....#150
Jet needle .....4 DG 6
Pilot jet .....#17.5
Needle jet 0-0
Throttle valve 2.0

Jet needle clip in third groove from top of needle.

When using a 22 MM carburetor, size of intake tract should be increased accordingly. Bore carburetor mounting lug in right crankcase cover to 22 MM (0.8661 inch). Valve cover plate (22—Fig. S2-14) should be modified as shown in Fig. ST2-2. Enlarge outside of cover just to limits of "O" ring seal (A). Blend enlarged hole in outside of cover to a 24 MM by 20.5 MM oval on inside of cover. Modify inner valve seat (16—Fig. S2-14), gasket (15) and crankcase port to match outer valve cover plate.

Standard rotary valve may be modified to meet kit specifications. R-T Kit rotary valve opens 2 degrees sooner than standard and closes 10 degrees later than standard.

Carburetor cover should be shimmed with 6-10 cover gaskets or carburetor bell mouth trimmed back to allow a less restrictive air flow to engine.

LUBRICATION. Only a high quality of air cooled two cycle engine oil should be used. Standard oil metering system may be used or disconnect control cable (pump must be left on) and use a 20:1 fuel-oil mix in the fuel tank. Oil pump will operate at idle to provide lubrication for crankshaft main bearings.

CYLINDER, HEAD AND PISTON. A special cylinder head with a 7.5:1 compression ratio is supplied in the Kit.

An R-T Kit cylinder differs from a standard cylinder in that exhaust is timed to begin opening 92 degrees ATDC instead of 98 degrees ATDC. Transfer ports are open a total of 126 degrees instead of stock 116 degrees. A standard cylinder may be modified to meet Kit specifications.

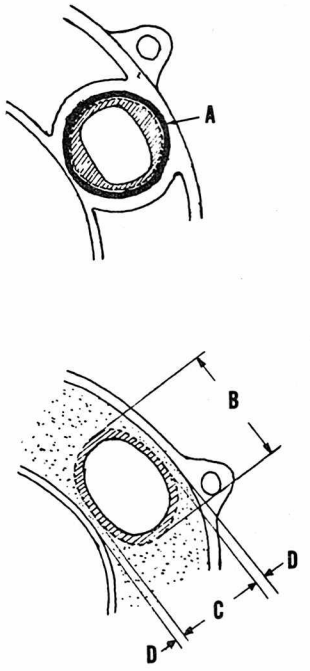


Fig. ST2-2—Outside of outer valve cover should be enlarged to limits of "O" ring seal. Inside of cover should have an oval opening 24 MM (B) by 20.5 MM (C). Hole should be 1.5 MM from each side of cover (D).

A special piston is used in the R-T Kit. Ring retaining pins are installed in rear of piston instead of forward part as in standard unit. Install all pistons with arrow on dome toward front of engine.

SUZUKI 120CC MODELS

MODEL	B100-P Magnum & B105-P Bearcat	TC Cat 120
Displacement-cc	118	118
Bore-MM	52	52
Stroke-MM	56	56
Number of cylinders	1	1
Engine oiling	Oil pump	Oil pump
Plug gap-inch	0.020-0.024	0.020-0.024
Point gap-inch	0.014	0.014
Ignition timing	Fixed	Fixed
Degrees BTDC	24	24
Electrical system voltage	6	6
Tire size-front	2.50x17*	2.75x18
Rear	2.75x17*	3.00x18
Tire pressure-front	20	16
Rear	28	20
Rear chain free play-inch	1	1
Number of speeds	4	3x2
Weight-lbs. (approx.)	190	205

*Tire size on B105-P Bearcat is 3.00x17 for both front and rear.

MAINTENANCE

SPARK PLUG. Spark plug electrode gap should be 0.020-0.024 inch. Recommended spark plug for normal use is NGK type B-7 or Champion HO-3 or UJ7P.

CARBURETOR. Mikuni VM20SH carburetor used is shown in Fig. S3-1. The idle mixture is adjusted at needle (11). Initial setting should be 1½ turns open. Idle speed is adjusted at adjuster (2). The float setting (H—Fig. S3-2) should be 0.984 inch. Refer to Fig. S3-1 and the following for standard jet sizes and specifications:

TC 120

Main jet (9) .....#100
Valve needle (6) 408
Needle jet (13) 0-0
Pilot jet (14) .....#25
Clip (5) in fourth groove from top of needle (6).

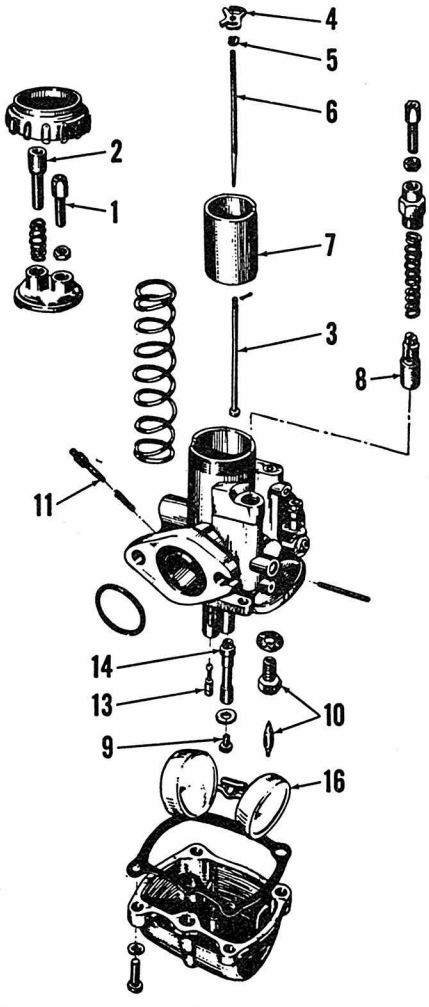


Fig. S3-1—Exploded view of Mikuni VM carburetor used.

1. Throttle cable guide
2. Idle speed adjuster
3. Idle speed rod
4. Retainer
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Fuel inlet valve
11. Idle mixture needle
13. Needle jet
14. Pilot jet
16. Float

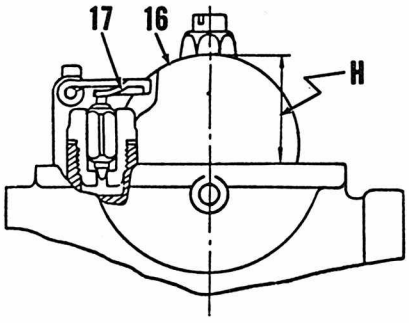


Fig. S3-2—Float level (H) is adjusted by bending tang (17). Make certain that both floats are the same.

B100-P & B105-P

Main Jet (9) ..... #95
Valve needle (6) 4F9
Needle jet (13) N-2
Pilot jet (14) .....#25
Clip (5) in fourth groove from top of needle (6).

IGNITION AND ELECTRICAL. The ignition primary coil (4—Fig. S3-3), lighting coils (2 & 3), ignition points (5) and condenser (7) are located on the stator plate (6) on left side of engine under the flywheel. Ignition points should be set to 0.014 inch fully open. Ignition should occur (points should just open) when the piston is 3.0MM (0.118 inch) BTDC. At this point, crankshaft should be 24° BTDC. Small adjustments can be made by changing the point gap between the limits of 0.012-0.016 inch; however, the stator plate should be moved in the elongated mounting holes. To move the stator plate, it is necessary to remove the flywheel and loosen the three retaining screws.

LUBRICATION. The oil injection system automatically meters and pumps oil from a separate tank to the left main bearings and the connecting rod lower bearing. After the pressurized oil lubricates these parts it is carried as a mist to lubricate the other engine parts. The oil tank should **never** be allowed to run dry. Keep tank filled with an oil intended for use in air cooled two cycle engines. The oil pump and metering unit is mounted on the right side cover plate as shown in Fig. S3-5. The oil pump drive gears (7 & 8) are lubricated by oil in the gear box and clutch. If the system is drained or pump unit is renewed, all oil lines should be filled before starting engine. Start engine and run at idle speed while pulling pump control cable up. Release the cable after exhaust begins to smoke excessively. If air bubbles are always in oil lines, check for air leak in lines or at large plug on rear of pump.

The pump control cable adjustment should be checked every 1000 miles. The engine may be damaged if cable adjustment is incorrect. To check, twist the throttle hand lever to maximum speed position and check clearance (A—Fig. S3-6) between pump control lever and the stop. If clearance is not 0.04 inch (1MM), loosen the lock nut and turn the pump control cable guide (14—Fig. S3-5) until clearance is correct.

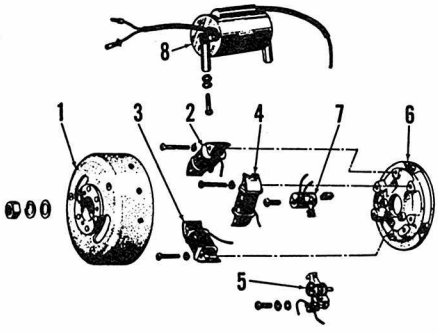


Fig. S3-3—Exploded view of the ignition and electrical system flywheel assembly. Ignition coil (8) is located inside frame under the fuel tank.

1. Flywheel
2. Lighting coil
3. Lighting coil
4. Ignition primary coil
5. Breaker points
6. Stator plate
7. Condenser
8. Ignition coil

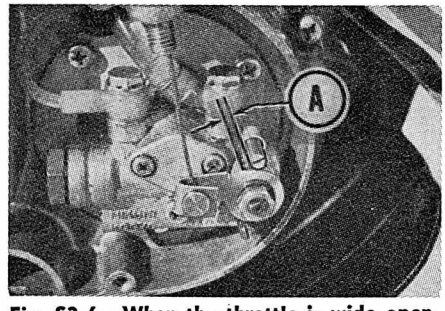
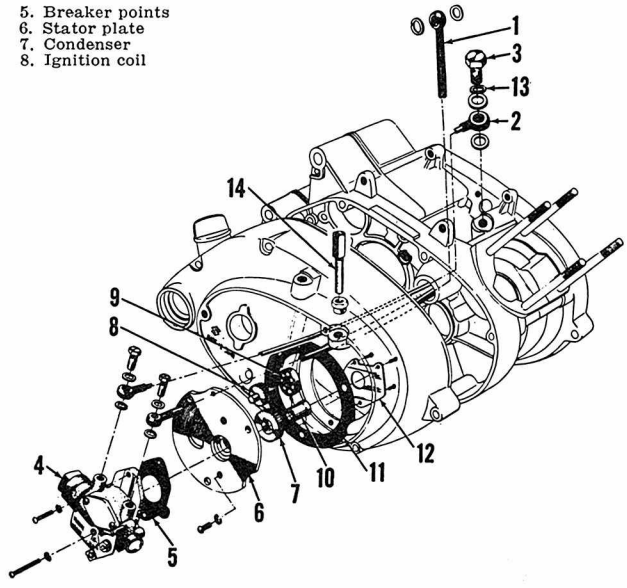


Fig. S3-6—When the throttle is wide open, clearance (A) should be 0.04 inch (1MM) between control lever and stop pin.

Fig. S3-5 — View of the engine oil injection system. Top end of the inlet oil line (1) connects to the oil tank filter. Gaskets are used on all banjo fittings; however, "O" ring (13) is also used at check valve (3).

1. Inlet oil line
2. Pressure line
3. Check valve
4. Oil pump
5. Gasket
6. Drive housing
7. Pump gear
8. Drive gear
9. Bearing
10. Pump drive shaft
11. Gasket
12. Cover plate
13. "O" ring
14. Pump control cable guide



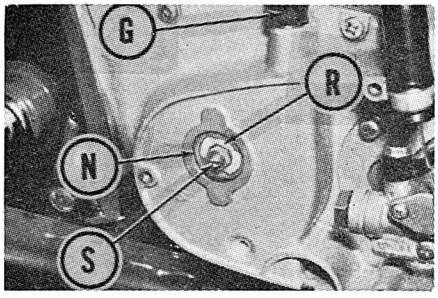


Fig. S3-8—View of engine right side showing clutch adjustment points.

G. Cable adjustment guide (under rubber cover)
N. Release nut
R. Release screw
S. Adjustment screw

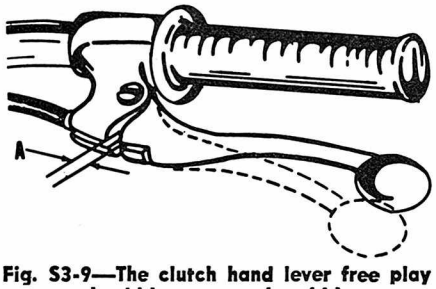


Fig. S3-9—The clutch hand lever free play should be measured at (A).

The check valve (3) should be tightened to 24-43 inch-pounds torque. The union bolts on oil lines at pump should be torqued to 17-24 inch-pounds.

CLUTCH CONTROLS. To adjust the clutch, remove the cover plate from the engine right side cover. Loosen the lock nut and turn the cable adjuster (G—Fig. S3-8) until the clutch release screw (R) is flush with outside of the release nut (N). Loosen lock nut and turn screw (S) IN until slight resistance is felt, then back screw out ¼-turn and retighten lock nut. Clutch hand lever should have 0.16 inch (4MM) free play at (A—Fig. S3-9). If free play is incorrect, cable adjustment (at guide G—Fig. S3-8) may be wrong or cable may be stretched.

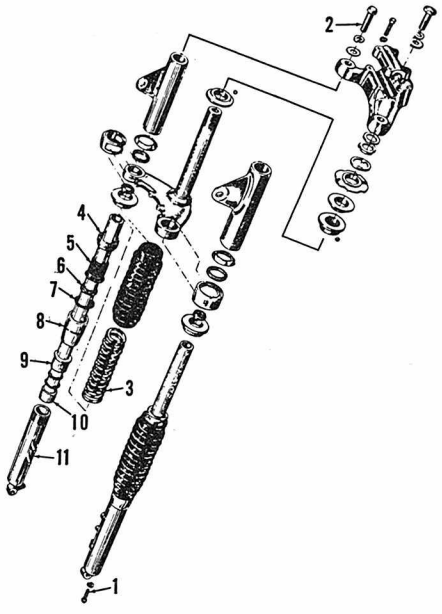


Fig. S3-10—Exploded view of the front suspension system.

1. Drain plug
2. Filler screw
3. Spring
4. Spring guide
5. Dust seal
6. Oil seal
7. "O" ring
8. Seal housing
9. Bushing
10. Inner tube
11. Lower tube

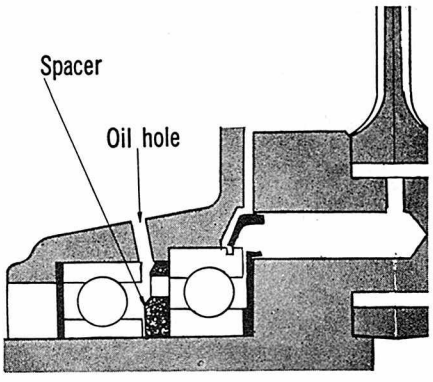


Fig. S3-14—When assembling the crankshaft left main bearings, make sure that spacer between bearings is installed with notches toward end as shown.

REPAIRS

PISTON, RINGS AND CYLINDER. The piston can be removed after removing exhaust pipe, carburetor, cylinder head and cylinder. Standard cylinder bore diameter is 2.04724-2.04783 inch (52.0-52.015MM). Refer to the following specifications:

Cylinder bore taper—
Wear limit ....0.002 in. (0.05MM)
Piston to cylinder
clearance .....0.0014-0.0018 in.
Wear limit .....0.0047 in.

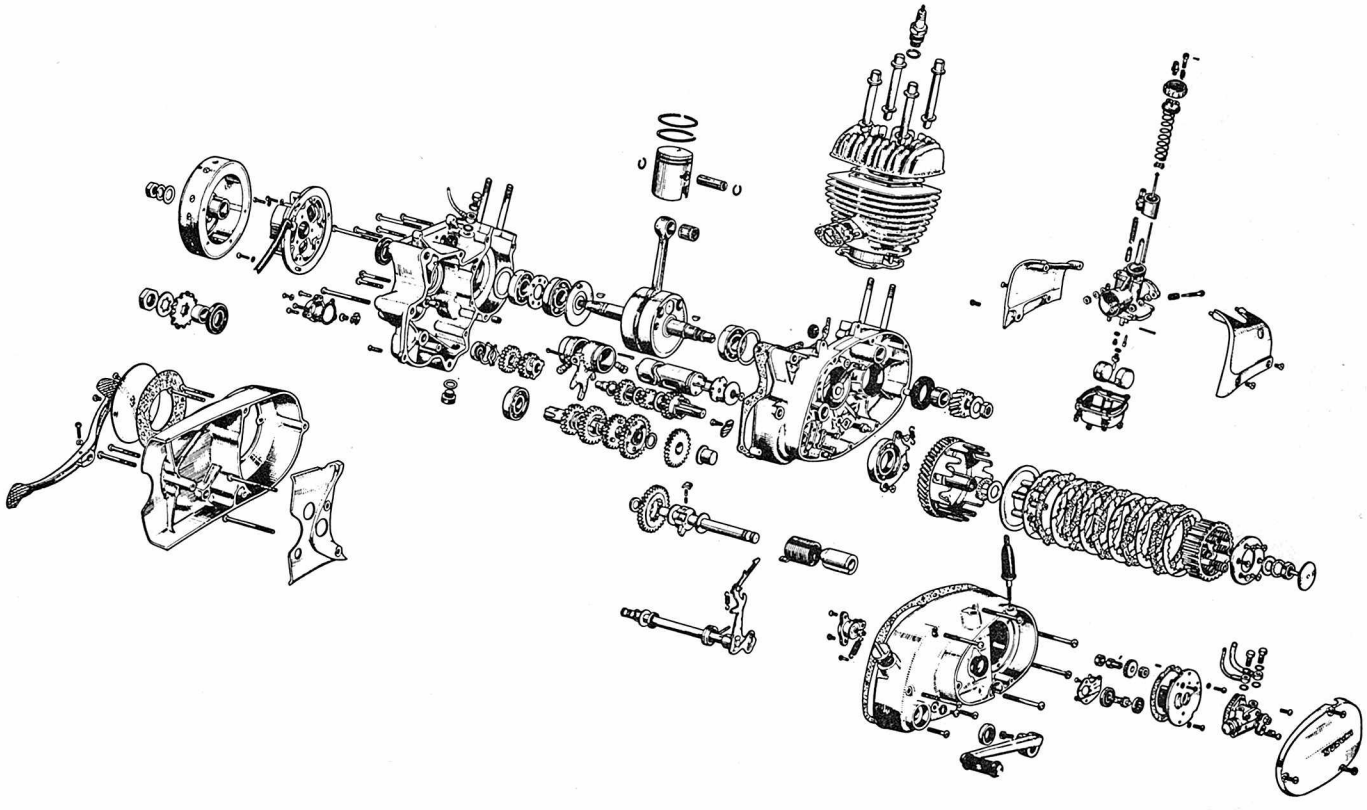


Fig. S3-12—Exploded view of the engine and transmission assembly used on B100-P and B105-P models. TC120 models are similar except for the dual range transmission (Fig. S3-15).

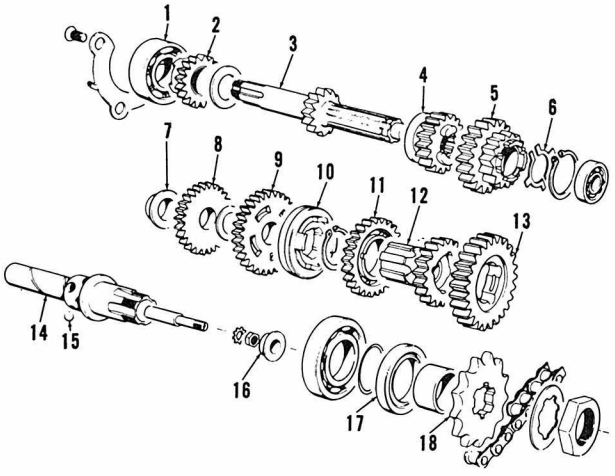
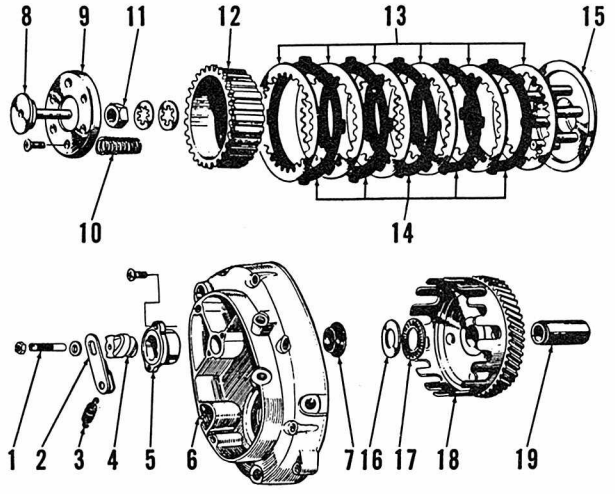


Fig. S3-15 — Exploded view of TC120 transmission.

1. Ball bearing
2. Kick starter driven gear
3. Counter shaft
4. Second drive gear
5. Third drive gear
6. Knock rings
7. Drive shaft bushing
8. Kick starter idle gear
9. First driven gear
10. Reduction driven gear
11. Second driven gear
12. Third driven gear
13. Reduction driven gear
14. Drive shaft
15. Steel ball
16. Shifting rod oil seal
17. Drive shaft oil seal
18. Drive sprocket



1. Adjusting screw
2. Release lever
3. Spring
4. Release screw
5. Release nut
6. Right side cover
7. Seal
8. Release plunger
9. Spring plate
10. Springs
11. Nut
12. Hub
13. Steel plates
14. Friction discs
15. Pressure plate
16. Thrust washer
17. Needle thrust bearing
18. Clutch drum
19. Bushing

Fig. S3-16—Exploded view of the clutch assembly. Hub (12) is splined to the transmission input shaft. The later type is shown, but early models are similar.

Ring end gap .....0.0039-0.0118 in.
Wear limit .....0.059 in.

Piston to cylinder clearance should be measured by measuring piston skirt diameter at right angles to piston pin 24MM (0.945 inch) above bottom of skirt and the cylinder bore diameter, then subtracting. Both piston rings are identical and should be installed with marked side toward top of piston. Rings are keystone type with top side tapered 7°. Use caution when cleaning the grooves. Piston must be installed with arrow on top aimed toward (exhaust port) front of engine. Oversize piston and rings are available. Make sure that rings correctly engage pins in grooves when installing cylinder. Cylinder head retaining nuts should be tightened diagonally to 180 inch-pounds torque.

CONNECTING ROD AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Connecting rod, crankpin and bearing are removed by pressing crankshaft apart. Crankshaft should be disassembled ONLY if required tools are available to correctly check and align the reassembled crankshaft. Maximum eccentricity allowed when supported at main bearings and checked at ends is 0.00158 inch (0.04 MM). Side play of connecting rod at the piston pin end (shake) should not exceed 0.118 inch (3MM). If shake is excessive, crankpin, lower bearings and connecting rod should be renewed. Refer to Fig. S3-14 when assembling the left main bearings and spacers. Notches in spacer should be toward end bearings. If incorrectly installed, spacer will block the oil passage and prevent oil from entering engine.

CLUTCH. To remove the clutch, remove the kick starter pedal, the oil injection pump and the pump drive housing. Remove the eight retaining screws and lift the right side cover out of the way. After nut (11—Fig. S3-16), is removed, parts (9, 10, 12, 13, 14 & 15) can be removed as an assembly. Thrust bearing (16 & 17) can be removed and inspected. Remove the six screws that attach spring plate (9) to the pressure plate (15) and separate parts (9, 10, 12, 13, 14 & 15). Refer to Fig. S3-16 and the following specifications:

Friction discs (14)—
Thickness .....0.118 inch
Wear limit .....0.110 inch
Warpage limit .....0.016 inch
Steel plates (13)—
Thickness .....0.063 inch
Wear limit .....0.059 inch
Warpage limit .....0.0039 inch
Springs (10)—
Free length .....1.30 inch
Minimum limit .....1.28 inch
Primary drive gears—
Backlash .....0.0008-0.0027 inch
Maximum limit .....0.0059 inch

When reassembling, make sure that rollers on thrust bearing (17—Fig. S3-16) face toward thrust washer (16). Tighten nut (11) to 36 Ft.-Lbs. torque. The clutch must be adjusted after assembly is complete. Refer to preceeding CLUTCH CONTROLS paragraphs in the Maintenance section.

CRANKCASE AND GEARBOX. To disassemble the crankcase and transmission, the engine must first be removed from frame. Carefully separate the crankcase halves, pulling the left half off and leaving gears and shafts in the right half as shown in Fig. S3-17.

Clearance between shifter forks (11 & 12—Fig. S3-18) and the grooves in gears (22 & 32) should be 0.008-0.016 inch. If clearance exceeds 0.032 inch, renew fork and/or gear. When renewing bushing (28), make sure oil holes are in open top part of right crankcase. Crankcase halves should be heated when removing and installing bearings. Oil seal (38) should be installed with open face toward inside. Be careful not to damage or roll the sharp outside lip on seal (38). When installing the positioning pieces (24) and snap ring (25) on gear (23), refer to Fig. S3-19. The opening in snap ring should **NOT** be aligned with split in the positioning pieces.

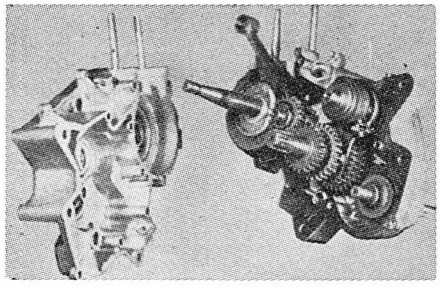
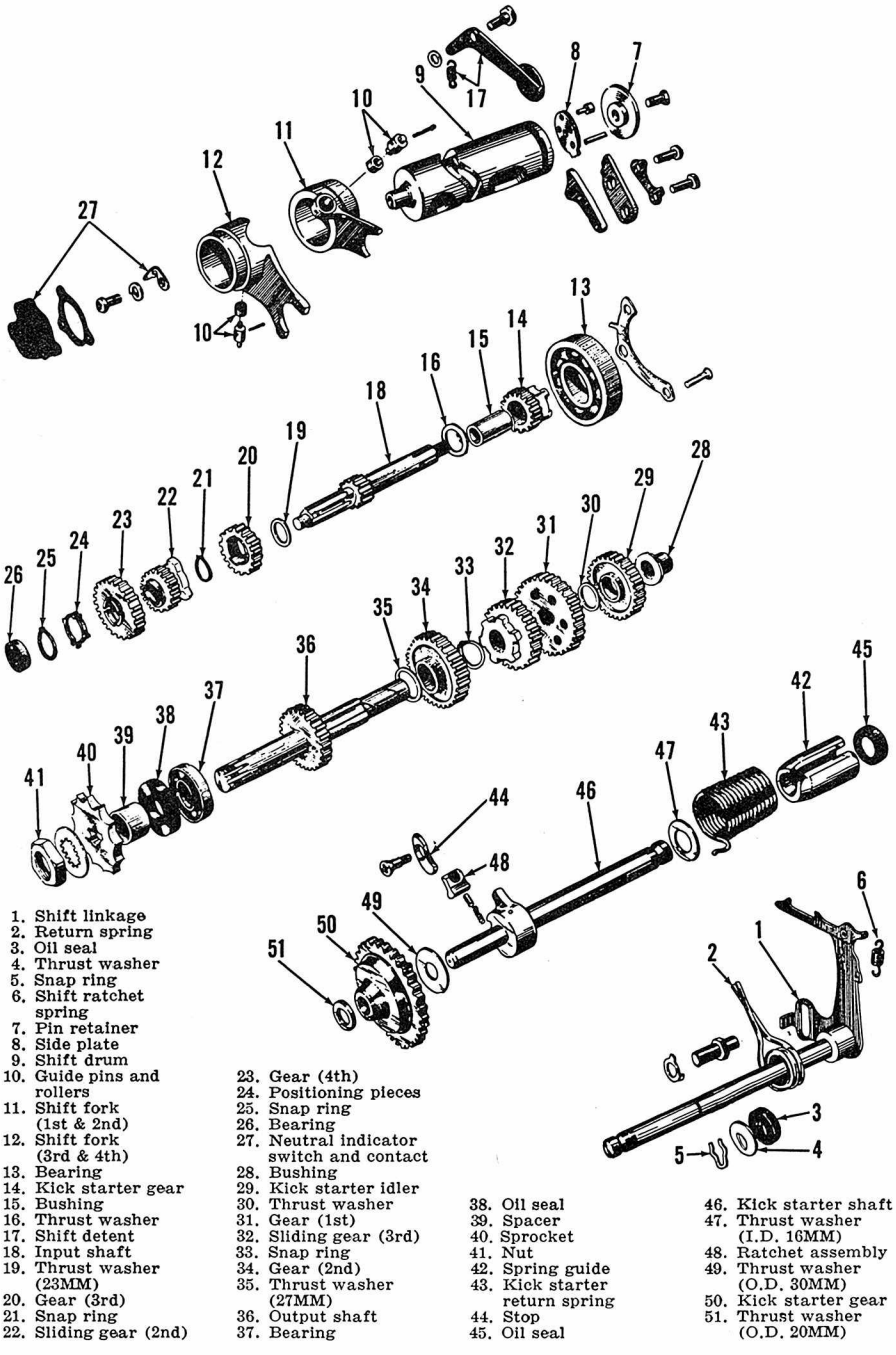


Fig. S3-17—View of the crankcase halves separated. Shaft and gears should be in the right side.



1. Shift linkage
2. Return spring
3. Oil seal
4. Thrust washer
5. Snap ring
6. Shift ratchet spring
7. Pin retainer
8. Side plate
9. Shift drum
10. Guide pins and rollers
11. Shift fork (1st & 2nd)
12. Shift fork (3rd & 4th)
13. Bearing
14. Kick starter gear
15. Bushing
16. Thrust washer
17. Shift detent
18. Input shaft
19. Thrust washer (23MM)
20. Gear (3rd)
21. Snap ring
22. Sliding gear (2nd)
23. Gear (4th)
24. Positioning pieces
25. Snap ring
26. Bearing
27. Neutral indicator switch and contact
28. Bushing
29. Kick starter idler
30. Thrust washer
31. Gear (1st)
32. Sliding gear (3rd)
33. Snap ring
34. Gear (2nd)
35. Thrust washer (27MM)
36. Output shaft
37. Bearing
38. Oil seal
39. Spacer
40. Sprocket
41. Nut
42. Spring guide
43. Kick starter return spring
44. Stop
45. Oil seal
46. Kick starter shaft
47. Thrust washer (I.D. 16MM)
48. Ratchet assembly
49. Thrust washer (O.D. 30MM)
50. Kick starter gear
51. Thrust washer (O.D. 20MM)

Fig. S3-18—Exploded view of the transmission used on B100-P and B105-P models. Kick starter and shifter assembly are similar on TC120 models.

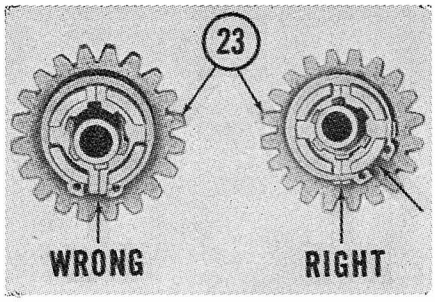


Fig. S3-19—View of fourth gear, positioning pieces and snap ring (23, 24 & 25—Fig. S3-18) assembled. Split in positioning pieces and opening in snap ring should not be aligned.

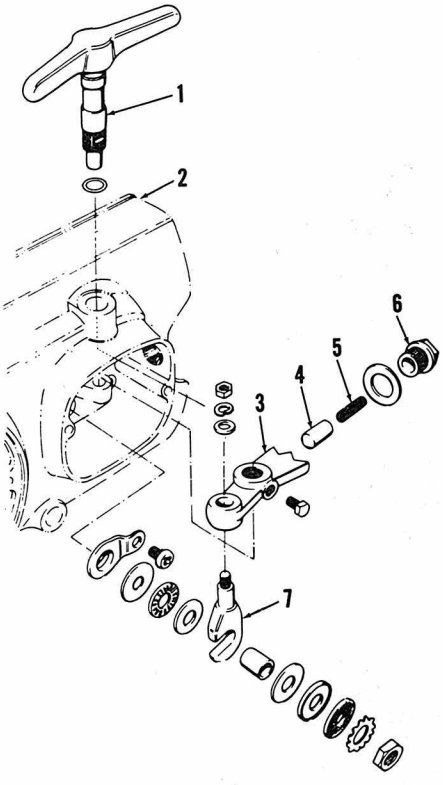


Fig. S3-20 — Exploded view of reduction shifter assembly used on TC120 models.

1. Shift lever
2. Left engine cover
3. Shifting arm
4. Shifting arm stopper
5. Shifting arm spring
6. Shifting arm housing
7. Shifting arm pin

SUZUKI S32-2 AND T10 TWINS

MODEL	T10	Olympian S32-2
Displacement-cc	246	149
Bore-MM	52	46
Stroke-MM	58	45
Number of cylinders	2	2
Oil-fuel ratio	1 to 20	1 to 20
Plug gap-inch	0.024-0.028	0.024-0.028
Point gap-inch	0.012-0.016	0.012-0.016
Ignition timing—Advance	Automatic	Fixed
Degrees BTDC-retarded	7	25
Degrees BTDC-advanced	30	———
Electrical system voltage	12	12
Battery terminal grounded	Negative	Negative
Tire size-front	3.00 X 17	2.75 X 17
Rear	3.00 X 17	2.75 X 17
Tire pressure psi-front	17	21
Rear*	27	28
Rear chain free play-inch	1½	1
Number of speeds	4	4
Weight-lbs. (Approx.)	309	253

*Increase rear tire pressure to 33 psi for T10 and 32 psi for S32-2 when carrying a passenger.

MAINTENANCE

SPARK PLUG. Recommended spark plugs are NGK type B-7 for T10, NGK type B-77C for S32. Electrode gap is 0.6-0.7 MM (0.024-0.028 in.) for all models.

CARBURETORS. All models use two Mikuni VM type carburetors. Model T10 uses VM20SC and S32-2 uses VM20SH. Fig. S4-1 shows typical VM carburetor. Refer to the following specifications.

Model T10

Carburetor model VM20SC
Main jet (9) 70
Air jet diameter .....1.3 MM
Needle jet (13) N-6
Pilot jet (14)—
Before engine No. 16816 30
After engine No. 16815 40

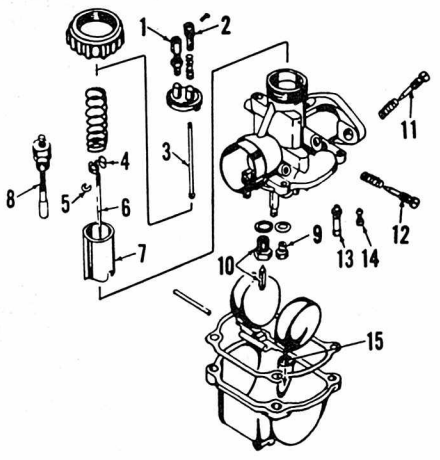


Fig. S4-1—Exploded view of typical VM type carburetor. Model VM20 SC uses a choke instead of starter valve shown.

1. Throttle cable adjuster
2. Idle speed adjuster (except VM20SC)
3. Idle speed rod
4. Retainer
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve (except VM20SC)
9. Main jet
10. Inlet valve
11. Idle mixture screw
12. Idle speed screw (VM20SC only)
13. Needle jet
14. Pilot jet
15. Starter jet (except VM20SC)

Idle mixture screw (11) normal setting—
Before engine No. 16816 (turns open) 1½
After engine No. 16815 (turns open) 2
Clip (5) position in needle (6)—
grooves from top.
Before engine No. 16816.....4
After engine No. 16815 2

Model S32-2

Carburetor model VM20SH
Main jet (9) 80
Air jet diameter .....1.3 MM
Needle jet (13) 0-4
Pilot jet (14) 25
Starter jet (15) 30
Idle mixture screw (11) normal setting 1¾ turns open.
Clip (5) in second groove from top of needle (6).

On all models, idle mixture is adjusted at screw (11—Fig. S4-1). Idle speed is adjusted at screw (12) on T10 models with VM20SC carburetor, at adjuster (2) for other models. Carburetors must be synchronized to begin opening at the same time by adjusting guides (1) at top of each carburetor. Idle mixture for one carburetor is more easily adjusted after disconnecting spark plug wire from the other cylinder. Intermediate speed mixture can be adjusted by raising or lowering clip (5) on needle (6) from the normal position. Throttle cables should have 0.5-1.0 MM (0.02-0.04 in.) play at the carburetors. Cable play must be the same for both carburetors.

IGNITION AND ELECTRICAL. Model T10 has a 12-volt combined starter-generator and a centrifugal advancing ignition mounted on the left end of the crankshaft. Model S32-2 has a combined starter-generator with a non-advancing ignition. Refer to the appropriate following paragraph.

MODEL T10. Refer to Fig. S4-2. Ignition point gap should be 0.3-0.4 MM (0.012-0.016 in.). Full advanced timing (points just open) should occur at 30 degrees BTDC and retarded timing at 7 degrees BTDC. Piston position is 0.27 MM (0.0166 in.) BTDC fully retarded, advanced is 4.76 MM (0.188 in.) BTDC. Timing marks (L & L+) are painted red for left cylinder, marks (R & R +) are painted blue for right cylinder. Retarded timing should occur when plain mark (L or R) is aligned with mark (S) on stator, advanced timing marks are at L+ and R+. Ignition timing is changed by moving breaker plate after loosening screws (L1) for left cylinder, (R1) for right cylinder.

Specifications for generator, starter and voltage-regulator are as follows.

STARTER - GENERATOR

Brush min. length .....12 MM
0.47 in.
Air gap .....0.45 MM
0.0177 in.
Nominal starter output .....0.26 KW
Torque .....9.39 ft.-lbs.
Max. Amperes 140
Voltage 8V
RPM 750
Nominal generator output 100W
Mica undercut .....0.5 MM
0.02 in.

REGULATOR

Voltage relay
No load voltage 14.4-15.6
Point gap .....0.2-0.4 MM
0.008-0.016 in.

Charging relay
Cut-in voltage 12.0-13.5
Point gap .....0.4-0.8 MM
0.016-0.032 in.

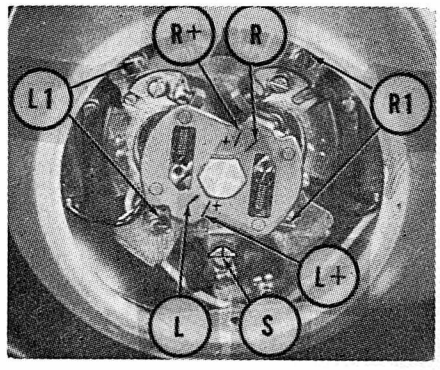


Fig. S4-2—View of timing marks for T10 model. Refer to text for adjustment procedure.

MODEL S32-2. Refer to Fig. S4-4. Ignition point gap should be 0.3-0.4 MM (0.012-0.016 in.). Timing does not advance and should occur at 25 degrees BTDC. Piston position is 2.1-2.85 MM (0.083-0.112 in.) BTDC. Timing mark (L) is painted red for left cylinder, mark (R) painted blue for right cylinder. Stator mark (S) can be moved, so timing should be checked with degree wheel or dial indicator whenever possible. Ignition timing is changed by moving breaker plate after loosening screws (L1) for left cylinder, (R1) for right cylinder.

Specifications for generator, starter and voltage regulator are as follows.

STARTER - GENERATOR

Brush min. length .....12 MM
0.47 in.

Air gap .....0.45 MM
0.0177 in.

Nominal starter output .....0.26 KW

Torque .....9.39 ft.-lbs.

Max. amperes 140

Voltage 8V

RPM 750

Nominal genrator output 100W

Mica undercut .....0.5 MM
0.02 in.

REGULATOR

Voltage relay

No load voltage 14.4-15.6

Point gap .....0.2-0.4 MM
0.008-0.016 in.

Charging relay

Cut-in voltage 12.0-13.5

Point gap .....0.4-0.8 MM
0.016-0.032 in.

LUBRICATION. The engine on T10 and S32-2 models is lubricated by mixing two stroke engine oil with premium gasoline. Normal ratio is 1:20; however, ratio of 1:15 should be used for first 1000 miles.

The gear box on model T10 uses 1.05 pints and model S32-2 uses 2.5 pints. All models use SAE 20W/40 engine oil.

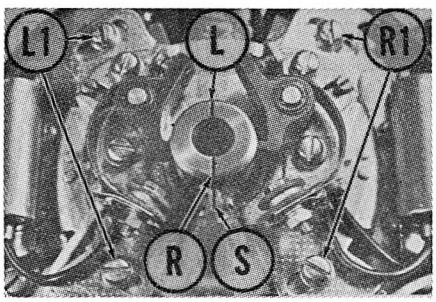


Fig. S4-4—View of timing marks for S32-2 model. Refer to text for adjustment procedure.

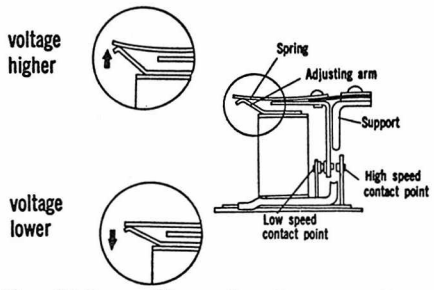


Fig. S4-5 — View of voltage regulator showing adjustment. Voltage should be 14.4-15.6.

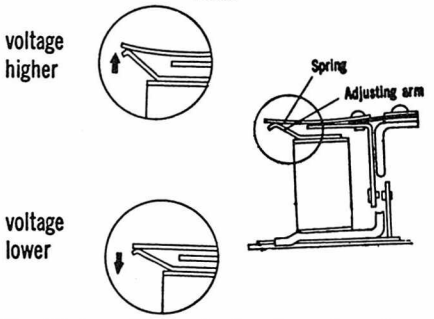


Fig. S4-6 — View of charging relay showing adjustment. Cut-in voltage should be 12.0-15.6.

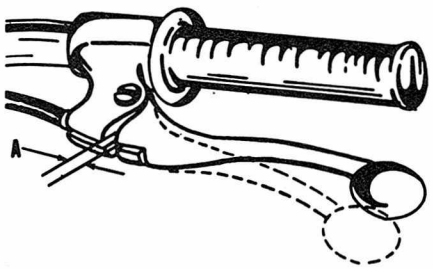


Fig. S4-7—Clutch hand lever free play should be measured at A. Refer to text.

CLUTCH. The clutch hand lever should have 4MM (0.16 in.) play at (A—Fig. S4-7). Normal adjustment is accomplished at the cable adjusters, however if nearly all cable adjustment has been used, refer to the following. Turn cable adjusters in and tighten screw (S—Fig. S4-8) until resistance is felt, then back screw out ½ turn and tighten lock nut. Adjust cable to provide correct hand lever clearance.

SUSPENSION. Capacity of each front suspension unit is as follows.

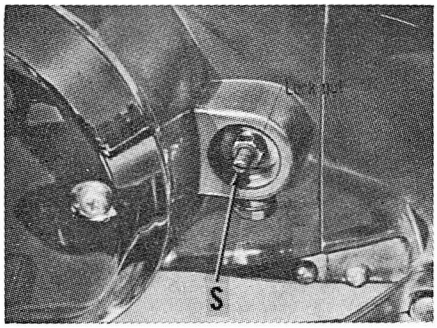


Fig. S4-8 — View of clutch adjustment screw for S32-2. Model T10 is similarly located on left side.

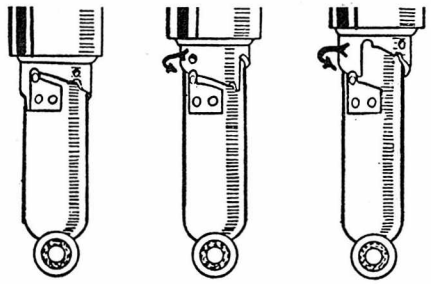


Fig. S4-9 — Rear suspension units are adjustable. Left view shows soft, center is medium and right is firm positions.

Model T10 uses 230 cc (½ pint) mixture of 6 parts SAE30 and 4 parts SAE60 oil. Model S32-2 uses 175-190cc (6-6½ oz.) SAE 30 engine oil.

Spring tension of rear units is adjustable as shown in Fig. S4-9. Shock absorber must be renewed if leaking, bent or damaged.

REPAIRS

PISTONS, RINGS AND CYLINDER. Each piston can be removed after removing exhaust pipe, carburetor, cylinder head and cylinder. Refer to the following specifications.

Ring end gap—

T10 .....0.15-0.35 MM
0.0059-0.0138 in.

wear limit .....1.0 MM
0.0394 in.

S32-2 .....0.1-0.3MM
0.0039-0.0118 in.

wear limit .....1.5 MM
0.059 in.

Ring groove clearance .....0.020-0.055 MM
0.0008-0.0022 in.

wear limit .....0.15 MM
0.0059 in.

Standard cylinder bore diameter—

T10 .....52.0-52.02 MM
2.0472-2.0476 in.

S32-2 .....46.0-46.015 MM
1.811-1.8116 in.

Piston skirt clearance—

T10 .....0.125 MM
0.00493 in.

wear limit .....0.3 MM
0.01182 in.

S32-2 .....0.055-0.065 MM
0.0022-0.0026 in.

wear limit .....0.125 MM
0.00493 in.

Piston skirt clearance in cylinder bore should be measured by first measuring piston diameter at right angles to piston pin and cylinder bore diameter, then subtracting. Piston diameter should be measured 0.9 inch from bottom for S32-2 and just below bottom ring for T10. On all T10 models and early S32-2 models, the chrome plated piston ring should be installed

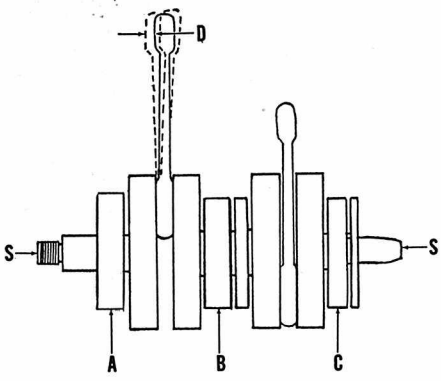


Fig. S4-10—With crankshaft supported between centers (S), crankshaft eccentricity when measured at points (A, B & C) must be less than 0.06 MM (0.0024 in.). Connecting rod play (D) should be less than 3 MM (0.118 in.).

in top groove. Piston rings on later S32-2 models are keystone type with top side tapered 7 degrees. Use care when cleaning the tapered grooves. Both keystone rings are interchangeable. On all models, rings should be installed with stamped mark toward top of piston. Piston must be installed with arrow on top pointing toward exhaust port. When cylinder is bored for oversize piston and rings, edges of all ports should be slightly beveled to prevent rings from catching and oversize cylinder head gasket installed. Cylinder head nuts should be tightened evenly to 12 Ft.-Lbs. for T10 and 11 Ft.-Lbs. for S32-2.

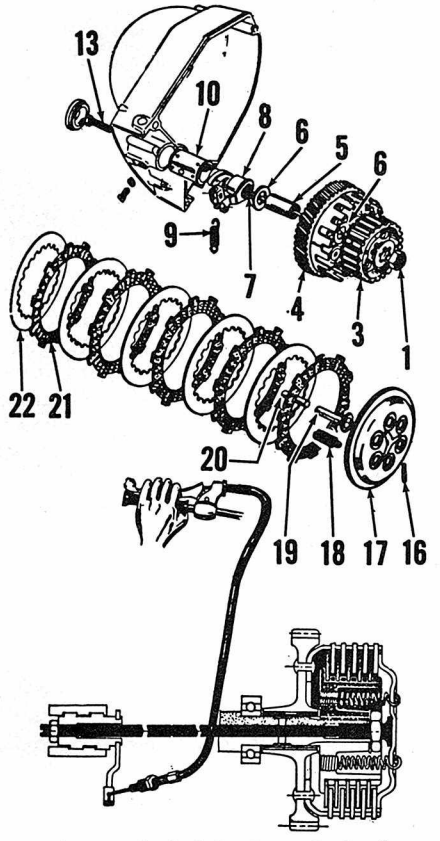


Fig. S4-11—Exploded view of clutch assembly used on T10 and S32 models.

3. Clutch hub
4. Clutch drum
5. Spacer
6. Thrust washers
7. Rod
8. Release screw
9. Spring
10. Release screw guide
13. Adjusting screw
16. Spring pins (6 used)
17. Pressure plate
18. Clutch springs (6 used)
19. Clutch release plunger
20. Rod
21. Friction discs
22. Steel plates

CONNECTING ROD AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Connecting rods, crankpins, rod bearings and center main bearing are removed by pressing crankshaft apart. Crankshaft should be disassembled **ONLY** if required tools are available to correctly check and align the reassembled crankshaft. Refer to Fig. S4-10. Maximum crankshaft eccentricity when checked at main bearings is 0.06 MM (0.0024 in.). Connecting rod, crankpin and bearing should be renewed if small end of rod has more than 3 MM (0.118 in.) side clearance as shown at (D—Fig. S4-10).

CLUTCH. The multiple disc, wet type clutch is mounted on the right end of the transmission input shaft and can be removed after removing the right side cover. Refer to Fig. S4-11 and the following specifications.

MODEL T10

Friction discs (21)—
thickness .....3.4-3.6 MM
0.134-0.142 in.
wear limit .....3.2 MM
0.126 in.
warpage limit .....0.25 MM
0.0098 in.

Steel plates (22)—
thickness .....1.6-1.8 MM
0.063-0.071 in.
wear limit .....1.5 MM
0.059 in.
warpage limit .....0.1 MM
0.0039 in.

Clutch springs (18)
installed length .....43 MM
1.69 in.

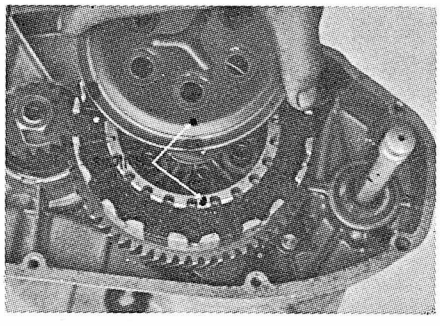


Fig. S4-12—View of alignment marks on pressure plate and hub.

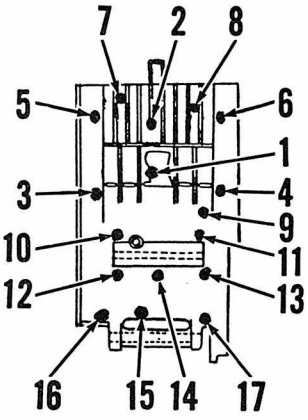


Fig. S4-14 — Crankcase screws should be tightened in sequence shown for S32-2 model.

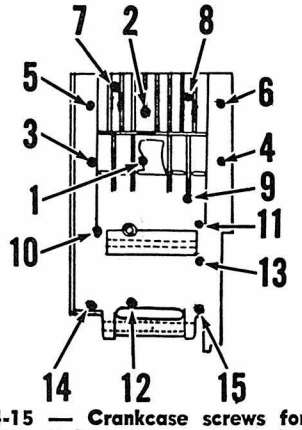


Fig. S4-15 — Crankcase screws for T10 should be tightened in sequence shown.

MODEL S32-2

Friction discs (21)—
thickness .....3 MM
0.118 in.
wear limit .....2.8 MM
0.110 in.
warpage limit .....0.4 MM
0.0016 in.

Steel plates (22)—
thickness .....1.6 MM
0.063 in.
wear limit .....1.5 MM
0.059 in.
warpage limit .....0.1 MM
0.0039 in.

Clutch springs (18)—
free length .....31 MM
1.22 in.
wear limit .....32.2 MM
1.27 in.

If side play of clutch drum (4) exceeds 0.3 MM (0.0118 in.), spacer (5) can be shortened on a hone to provide clutch drum with 0.1-0.25 MM (0.0039-0.0098 in.) side play. Clutch springs (18) should be screwed into hub (3) until flush with back side. Marks on pressure plate (17) and hub (3) should be aligned as shown in Fig. S4-12. Clutch hub nut (1—Fig. S4-11) should be torqued to 31 Ft.-Lbs. Adjustment of clutch controls is outlined in a pre-

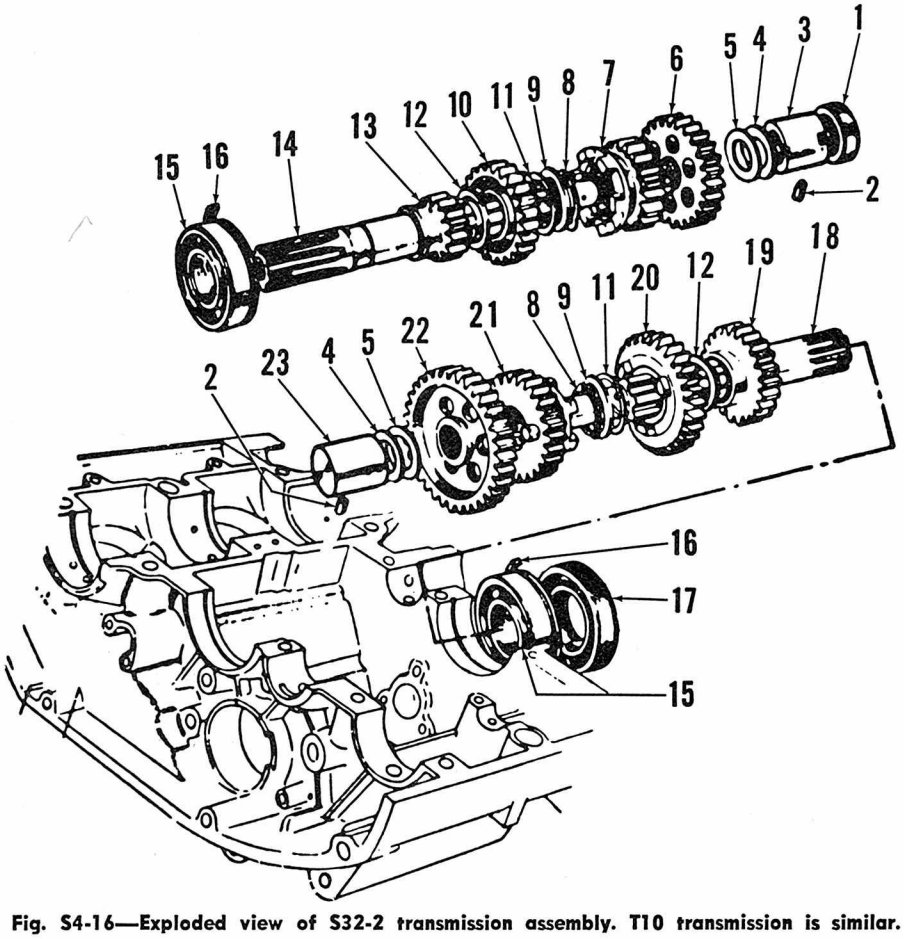


Fig. S4-16—Exploded view of S32-2 transmission assembly. T10 transmission is similar.

1. Clutch push rod oil seal
2. Dowel pin
3. Counter shaft bushing
4. Thrust washer
5. Shims
6. Fourth pinion
7. Second pinion
8. Snap ring
9. Thrust washer
10. Third pinion
11. Shims
12. Thrust washer
13. First pinion
14. Counter shaft
15. Ball bearings
16. Bearing positioning ring
17. Oil seal
18. Drive shaft
19. Fourth gear
20. Second gear
21. Third gear
22. First gear
23. Drive shaft bushing

vious paragraph in MAINTENANCE section.

CRANKCASE AND GEAR BOX. The transmission shafts and gears can be removed and disassembled after separating crankcase halves as follows. Remove engine and gear box assembly from frame. Remove cylinder heads, cylinders, pistons, side covers, ignition and charging assembly, clutch, gear shift linkage and screws (1 thru 17—Fig. S4-14 or 1 thru 15 Fig. S4-15). Remove screws in reverse order shown in Fig. S4-14 or S4-15.

Gear shift forks should have 0.2-0.4 MM (0.008-0.016 in.) clearance in grooves. Forks and/or gears should be renewed if clearance exceeds 0.8 MM (0.032 in.). Fourth pinion (6—Fig. S4-16) and low gear (22) should have very little side play, but be free to turn. Side play of gears (6 & 22) is adjusted by adding adjusting washers as shown in Fig. (S4-17. Third pinion (10) and second gear (20) should very little side play, but be free to rotate. Side play of gears (10 & 20) is adjusted by adding adjusting washers as shown in Fig. S4-18. Cotter pins for shifter fork pins (Fig. S4-19) should be installed from inside of fork toward outside as shown in lower view. Countershaft bushing (3—Fig. S4-16) has open end, drive shaft bushing (23) has closed end.

Sealing surfaces of crankcase halves should be sealed with an appropriate hardening type sealer.

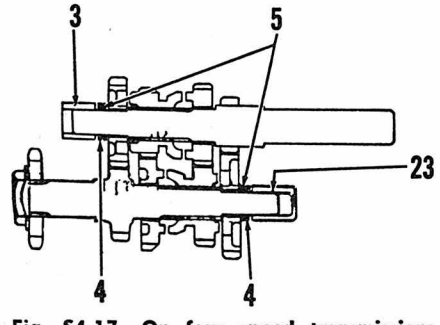


Fig. S4-17—On four speed transmissions, fourth pinion and first gear shims (5) should be installed next to gears with thrust washers (4) against bushings.

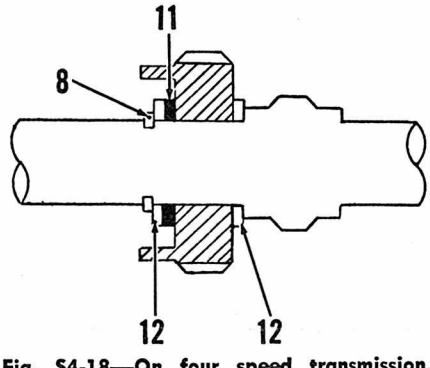
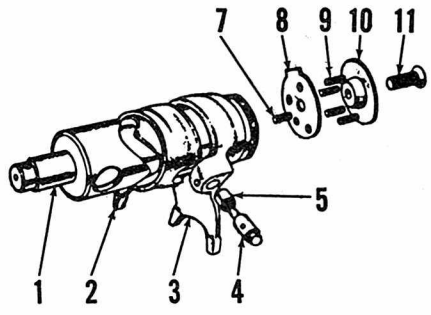


Fig. S4-18—On four speed transmission, third pinion and second gear shims (11) should be installed next to gears with thrust washers (12) next to shaft shoulder and snap ring (8).



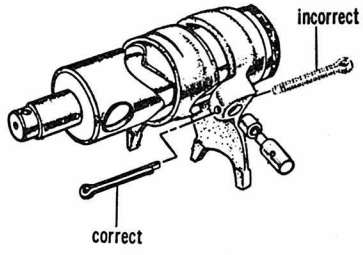


Fig. S4-19—Exploded view of four speed gear shift assembly. Cotter pins in guide pins (4) should be installed from middle of shifter assembly outward.

1. Gear shift cam
2. High speed fork
3. Low speed fork
4. Guide pin (2 used)
5. Guide roller (2 used)
7. Dowel pin
8. Cam side plate
9. Cam pin (4 used)
10. Cam pin retainer

TIGHTENING TORQUES. Crankcase screws should be tightened in sequence shown in Fig. S4-14 or S4-15. Cylinder head nuts should be tightened diagonally and evenly.

S32-2

Cylinder head (14 MM) ....11 ft.-lbs.
Crankshaft gear nut
(21 MM) .....**43 ft.-lbs.**
Drive sprocket (29 MM) ..65 ft.-lbs.
Crankcase screws—
6 MM (10 MM head) ....6 ft.-lbs.
8 MM (12 MM head) ....14 ft.-lbs.
Handle bar clamp screw
(10 MM) .....6 ft.-lbs.
Top fork screw (17 MM) 20 ft.-lbs.
Fork clamp screw (14 MM) 20 ft.-lbs.
Gear shift lever (10 MM) ..6 ft.-lbs.

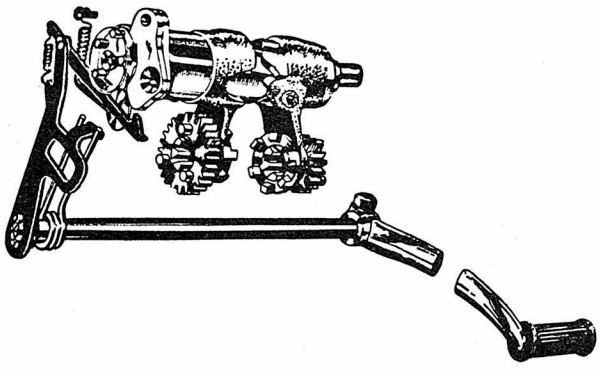


Fig. S4-20 — View of four speed gear shifting mechanism.

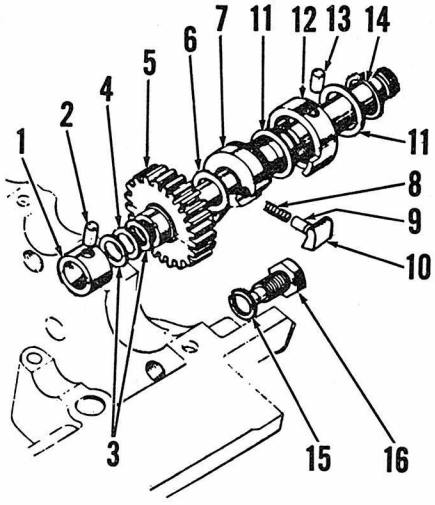


Fig. S4-21—Exploded view of kick starter assembly used on four speed transmission.

1. Bushing
2. Dowel pin (10 MM long)
3. Thrust washers (0.5 MM thick)
4. Spring washer
5. Starter pinion
6. Thrust washer (1.5 MM thick)
7. Starter shaft
8. Spring
9. Pawl pin
10. Starter pawl
11. Thrust washers (1.0 MM thick)
12. Bushing
13. Dowel pin (12 MM long)
14. Snap ring
16. Stop pin

Rear shock absorber—
lower screw (17 MM) ....20 ft.-lbs.
top nut (17 MM).....24 ft.-lbs.
Rear suspension pivot
(21 MM) .....28 ft.-lbs.
Front and rear axles
(23 MM) .....50 ft.-lbs.
Wheel sprocket nuts .....13 ft.-lbs.
Rear sprocket drum nut
(32 MM) .....755 in.-lbs.
Fuel cock union (32 MM) 4 ft.-lbs.
Spark plug (21 MM) ....14 ft.-lbs.
Engine support pipe lower
screw (12 MM) .....9 ft.-lbs.
Engine mounting screws
(12 MM) ..... 13 ft.-lbs.

T10

Cylinder head (14 MM) 100 in.-lbs.
Armature screw (14 MM) 95 in.-lbs.
Drive sprocket (33 MM) ..75 ft.-lbs.
Clutch hub nut (29 MM) 370 in.-lbs.
Crankshaft gear nut
(33 MM) .....520 in.-lbs.
Crankcase screws—
6 MM (10 MM head) ....6 ft.-lbs.
8 MM (14 MM head) ....14 ft.-lbs.

SUZUKI X-5 AND EARLY X-6 MODELS

MODEL	X-5 Invader & Stingray T200 & TC200	X-6 Hustler & Scrambler T20 & TTC250**
Displacement-cc	196	247
Bore-MM	50	54
Stroke-MM	50	54
Number of cylinders	2	2
Engine oiling system	"Posi-Force"	"Posi-Force"
Plug gap-inch	0.024-0.028	0.024-0.028
Point gap-inch	0.012-0.016	0.012-0.016
Ignition timing-	Fixed	Fixed
Degrees BTDC	24	27
Electrical system voltage	12	12
Battery terminal grounded	Negative	Negative
Tire size-front	2.75x18	2.75x18*
Rear	2.75x18	3.00x18*
Tire pressure-front	22	23
Rear	27	25
Rear chain free play-inch	¾	¾
Number of speeds	5	6
Weight-lbs. (approx.)	269	297

*Tire size for X-6 Scrambler (TC250) is 3.00x18 front and 3.50x18 rear.
**Later T250, T250II and T250R models are included in a following section.

MAINTENANCE

SPARK PLUGS. Spark plug electrode gap should be 0.024-0.028 inch. Recommended spark plug for normal use is NGK type B77HC for all models.

CARBURETORS. Two Mikuni VM 22SH carburetors are used on X-5 (200cc) models. Two Mikuni VM 24SH carburetors are used on X-6 (250cc) models. The idle mixture is changed by turning needle (11—Fig. S5-1). Initial setting is 1½-1¾ turns open. Turning the needle counter-clockwise leans the idle mixture. Idle speed is changed by turning adjusters (2). Make sure that throttle slides (7) both stop at same time when they reach idle speed stop. Carburetors must be synchronized to open exactly the same by turning cable guides (1) on top of carburetors. Throttle cables should have approximately $\frac{1}{32}$ inch play at the carburetors. Cable play must be the same for both carburetors. Float level (H—Fig. S5-2) should be 25MM (0.985 inch) and is adjusted by bending tang (17) on float. Refer to Fig. S5-1 and the following specifications:

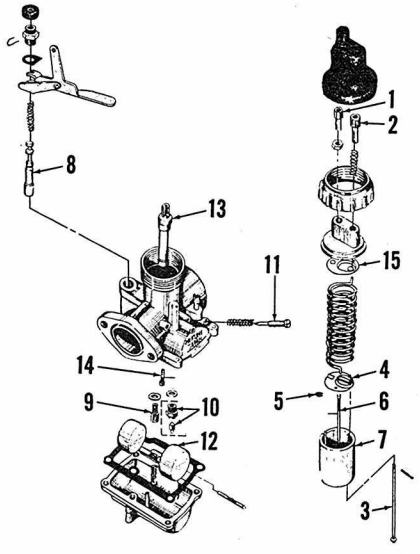


Fig. S5-1—Exploded view of typical Mikuni carburetor used.

1. Throttle cable guide
2. Idle speed adjuster
3. Idle speed rod
4. Retainer
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Inlet valve
11. Idle mixture needle
12. Float
13. Needle jet
14. Pilot jet
15. Spring upper seat (X-6 only)

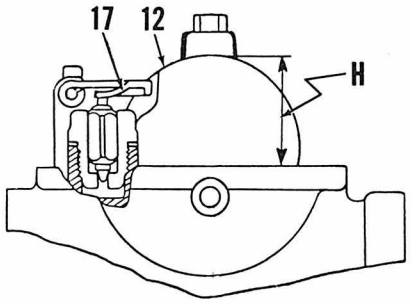


Fig. S5-2—Float level (H) is adjusted by bending tang (17).

VM22SH Carburetors (X-5 Models)

Main jet (9) .....#140
Pilot jet (14) .....#25
Needle jet (13) N-8
Valve needle (6) 4DG6
Clip (5) in third groove from top of needle (6).

VM24SH Carburetors (X-6 Models)

Main jet (9) .....#95
Pilot jet (14) .....#35
Needle jet (13) N-6
Valve needle (6) 4DH5
Clip (5) in third groove from top of needle (6).

IGNITION AND ELECTRICAL. Both models use a battery ignition system with an alternator mounted on the left end of the crankshaft which charges the battery via a full wave rectifier.

Ignition breaker point gap should be 0.014 inch for each set of breaker points. Ignition timing does not advance and should occur (points just open) at 24 degrees BTDC on X-5 models and 27 degrees BTDC on X-6. Timing marks (TM—Fig. S5-3) on rotor are painted red for left cylinder, black for right cylinder. Ignition should occur when rotor timing mark (TM) aligns with mark (S) on stator as seen through the small opening. Ignition timing for left cylinder is changed by moving the breaker plate after looosening screws (L1). Ignition timing for right cylinder is changed by moving breaker plate after loosening screws (R1). Slight changes in both cylinders can be made by moving the complete stator plate after loosening three screws (P).

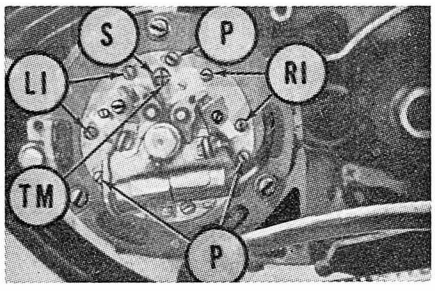


Fig. S5-3—View of ignition timing marks. Refer to text for adjustment procedure.

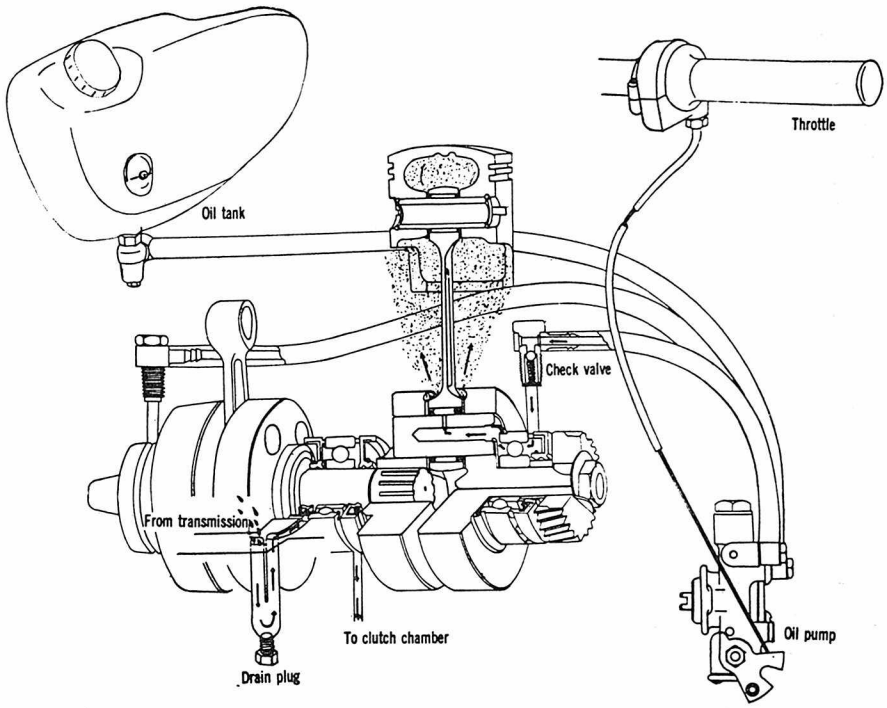


Fig. S5-4—View of "Posi-Force" lubrication system used on X-6 models. On X-5 models, additional oil lines are used to deliver oil to the cylinder walls. Cable (from throttle) meters amount of oil delivered to the crankshaft.

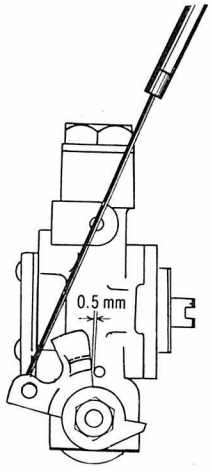


Fig. S5-5—Clearance between "Posi-Force" control lever on pump and stop should be 0.5MM (0.019 inch) as shown with throttle fully open.

LUBRICATION. The engine is lubricated by oil contained in a separate tank. A pump and metering unit pumps oil from the tank to the left and right main bearings and the connecting rod lower bearings. On X-5 models, additional oil lines direct oil to small holes in the lower part of each cylinder. On X-6 models, the cylinder is lubricated by excess oil thrown off by the connecting rod. On all models, the center main bearings are lubricated by oil contained in the gear box. Refer to Fig S5-4.

The oil tank should **never** be allowed to run dry. Some of the recommended oils are "Shell 2T Two Stroke Oil", "Mobile Super" and "Super Shell" motor oils.

To adjust the pump control cable, twist the throttle to full open and make sure that both throttle slides are completely to the top. Check the clearance between control lever and stop as shown in Fig. S5-5. If clearance is not 0.5MM (0.019 inch), turn the cable adjuster (A—Fig. S5-6). If clearance is not 0.019 inch, an improper amount of oil will be delivered and may result in engine damage. Make sure that adjuster lock nut is tightened after adjustment is complete.

The oil injection pump is available only as a unit and should not be disassembled. Grooved side of gaskets (3 & 9—Fig. S5-7) should be toward sides of banjo fitting at ends of oil lines.

If oil lines are drained or pump is renewed, it is important that all oil lines be filled with oil before engine is started. With oil lines primed, start engine and allow to idle. Pull the oil pump control cable out of adjuster (A—Fig. S5-6) and pull cable up until

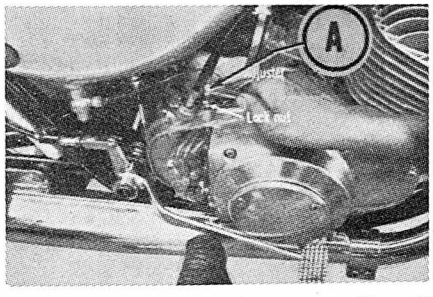


Fig. S5-6—"Posi-Force" control cable adjuster is shown.

the exhaust begins to smoke excessively.

The gear box on both models contains 1.1 quarts of oil. Multigrade SAE 20W/40 oil should be used.

CLUTCH CONTROLS. The clutch hand lever should have 0.12 inch free play at (A—Fig. S5-9). The clutches used on X-5 and X-6 are different. Refer to the appropriate following paragraph for adjustment procedure.

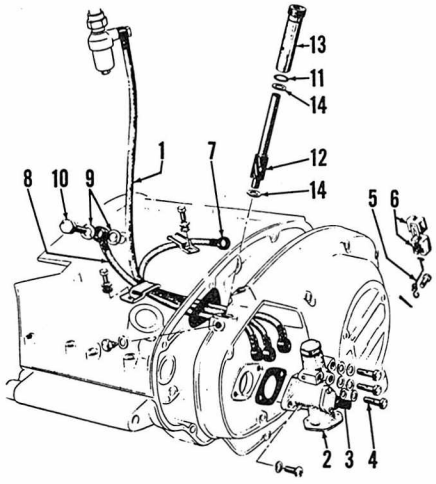


Fig. S5-7—View of "Posi-Force" lubrication system used on X-6 models. System used on X-5 models is similar. Seals (9 & 3) should be renewed each time they are removed.

1. Oil line from tank to pump
2. "Posi-Force" pump and metering valve
3. Seals
4. Union bolts
5. Connector link
6. Connector
7. Right main bearing pressure line
8. Left main bearing pressure line
9. Seals
10. Check valves (2 used)
11. O ring
12. Tachometer drive
13. Drive gear bushing
14. Thrust washers 1.0 MM thick)

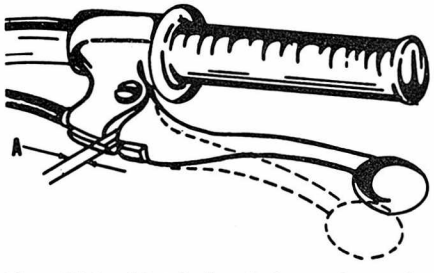


Fig. S5-9—Clutch hand lever free play should be measured at (A). Refer to text for adjustment.

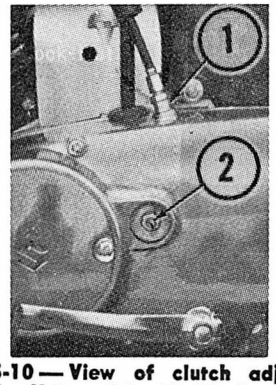


Fig. S5-10—View of clutch adjustment points for X-5 models. Model shown is not X-5, however positions on left side are similarly located.

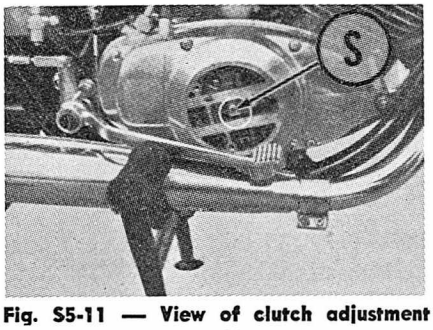


Fig. S5-11 — View of clutch adjustment screw (S) for X-6 models.

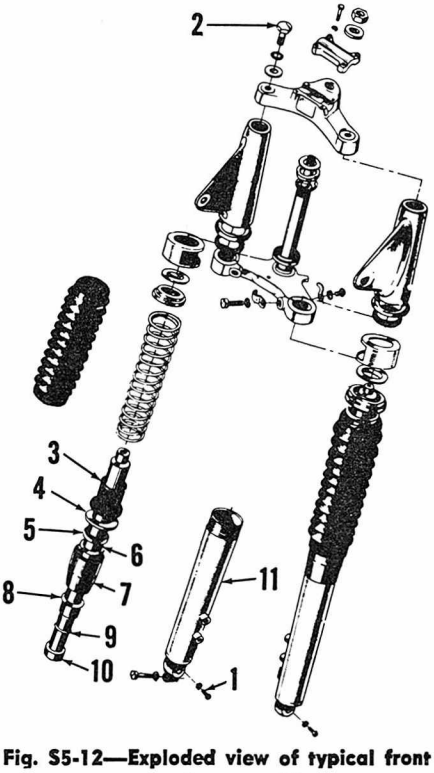


Fig. S5-12—Exploded view of typical front suspension assembly.

1. Drain plug
2. Filler screw
3. Dust seal
4. Spring seat
5. Oil seal
6. O ring
7. Seal housing
8. Bushing
9. O ring
10. Inner tube
11. Lower tube

X-5 Models. To adjust the clutch refer to Fig. S5-10. Loosen the lock nut on cable adjuster and turn the cable adjuster (1) in. Loosen the lock nut and turn the adjusting screw (2) in until slight resistance is felt then back screw (2) out ½ turn and tighten the lock nut. Turn the cable adjuster (1) until free play at (A—Fig. S5-9) is 0.12 inch.

X-6 Models. To adjust the clutch, refer to Fig. S5-11. Loosen the lock nut and turn screw (S) in until slight resistance is felt. Back screw out ½ turn and tighten the lock nut. Adjust the cable adjuster at hand lever to provide 0.12 inch free play at (A—Fig. S5-9).

SUSPENSION. Capacity of each front suspension unit is 180cc for X-5 models; 220cc for X-6 models. Oil used should be SAE 30 motor oil.

REPAIRS

PISTONS, RINGS AND CYLINDERS. Each piston can be removed after removing exhaust pipe, carburetor, cylinder head and cylinder. Refer to the following specifications:

Ring end gap .....0.0039-0.0100 inch
Wear limit .....0.040 inch
Ring groove
clearance .....0.0008-0.0020 inch
Wear limit .....0.0059 inch

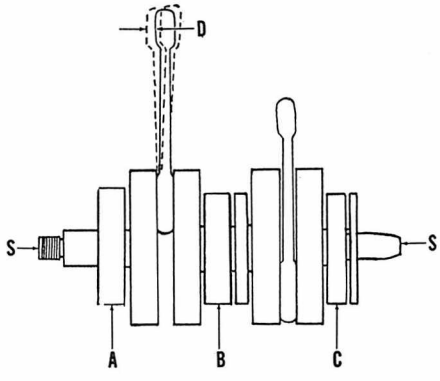
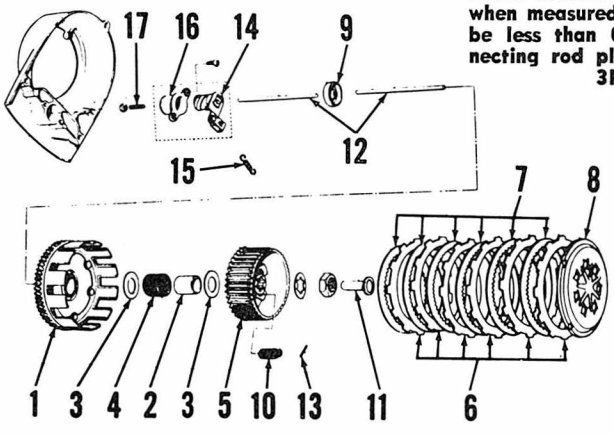


Fig. S5-14—With crankshaft supported between centers (S), crankshaft eccentricity when measured at points (A, B & C) must be less than 0.06MM (0.0024 in.). Connecting rod play (D) should be less than 3MM (0.118 in.).



1. Clutch drum
2. Spacer
3. Thrust washers
4. Bearing
5. Clutch hub
6. Friction discs
7. Driven plates
8. Pressure plate
9. Push rod seal
10. Springs
11. Clutch release plunger
12. Clutch push rods
13. Spring retaining pins
14. Release screw
15. Spring
16. Release nut
17. Adjusting screw

Fig. S5-15—Exploded view of X-5 clutch assembly.

Standard cylinder bore diameter—
X-5 .....50.0-50.015MM
1.98149-1.98208 inches
X-6 .....54.0-54.015MM
2.13897-2.13965 inches
Piston skirt to cylinder clearance—
All models .....0.0020-0.0024 inch
Wear limit .....0.0045 inch
Maximum cylinder bore taper
or out of round .....0.002 inch

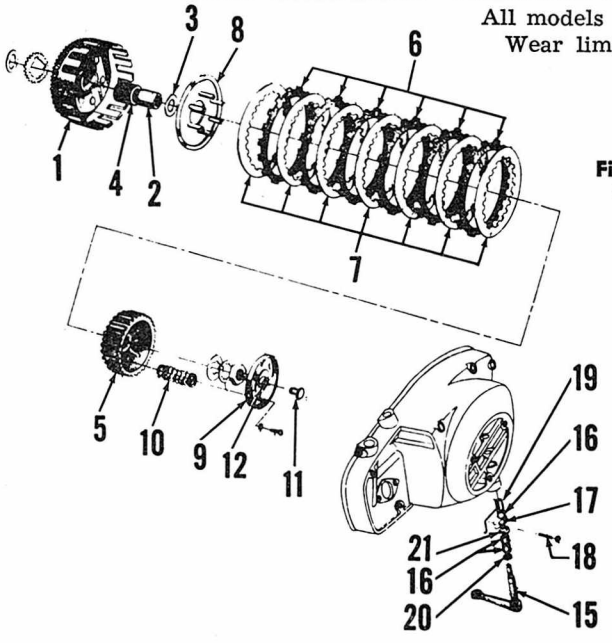


Fig. S5-16—Exploded view of X-6 clutch assembly.
1. Clutch drum
2. Spacer
3. Thrust washer
4. Bearing
5. Clutch hub
6. Friction discs
7. Driven plates
8. Pressure plate
9. Spring plate
10. Clutch springs
11. Release button
12. Clutch release plunger
15. Clutch lever
16. Bushings
17. Release cam
18. Adjusting screw
19. Return spring
20. Oil seal
21. Snap ring

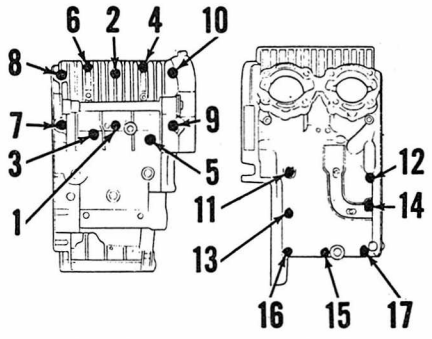


Fig. S5-19—Crankcase screws for X-5 models should be tightened in the sequence shown. Loosen screws in reverse order to prevent warpage.

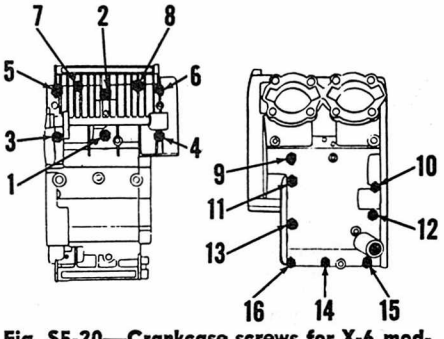


Fig. S5-20—Crankcase screws for X-6 models should be tightened in the sequence shown. Refer to Fig. S5-19 for 200cc models.

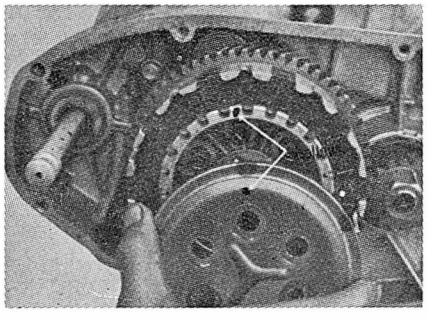


Fig. S5-17—View of alignment marks on pressure plate and hub of X-5 models.

Fig. S5-21—Exploded view of the X-5 engine and transmission assembly. Flanges (S) on shift forks should be toward right side as shown.

Piston skirt clearance in cylinder bore should measured by first measuring piston diameter at right angles to piston pin and cylinder bore diameter, then subtracting. Piston diameter should be measured 26MM (1.02 inch) from bottom of piston for X-6 models; 21MM (0.83 inch) from bottom for X-5 models. Rings should be installed with stamped mark toward top of piston. Piston must be installed with arrow on top pointing toward front (exhaust port). When cylinder is bored for oversize piston and rings, edges for all ports should be slightly beveled to prevent rings from catching and oversize cylinder head gasket installed. Cylinder head nuts should be tightened diagonally and evenly to 174 inch pounds torque.

CONNECTING ROD AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Connecting rods, crankpins, rod bearings and center main bearing are removed by pressing crankshaft apart. Crankshaft should be disassembled **ONLY** if required tools are available to correctly check and align the reassembled crankshaft. Maximum crankshaft eccentricity when checked at main bearings is 0.06MM (0.0024 in.). Connecting rod, crankpin and bearing should be renewed if small end of rod has more than 3MM (0.118 in.) side clearance as shown at (D—Fig. S5-14).

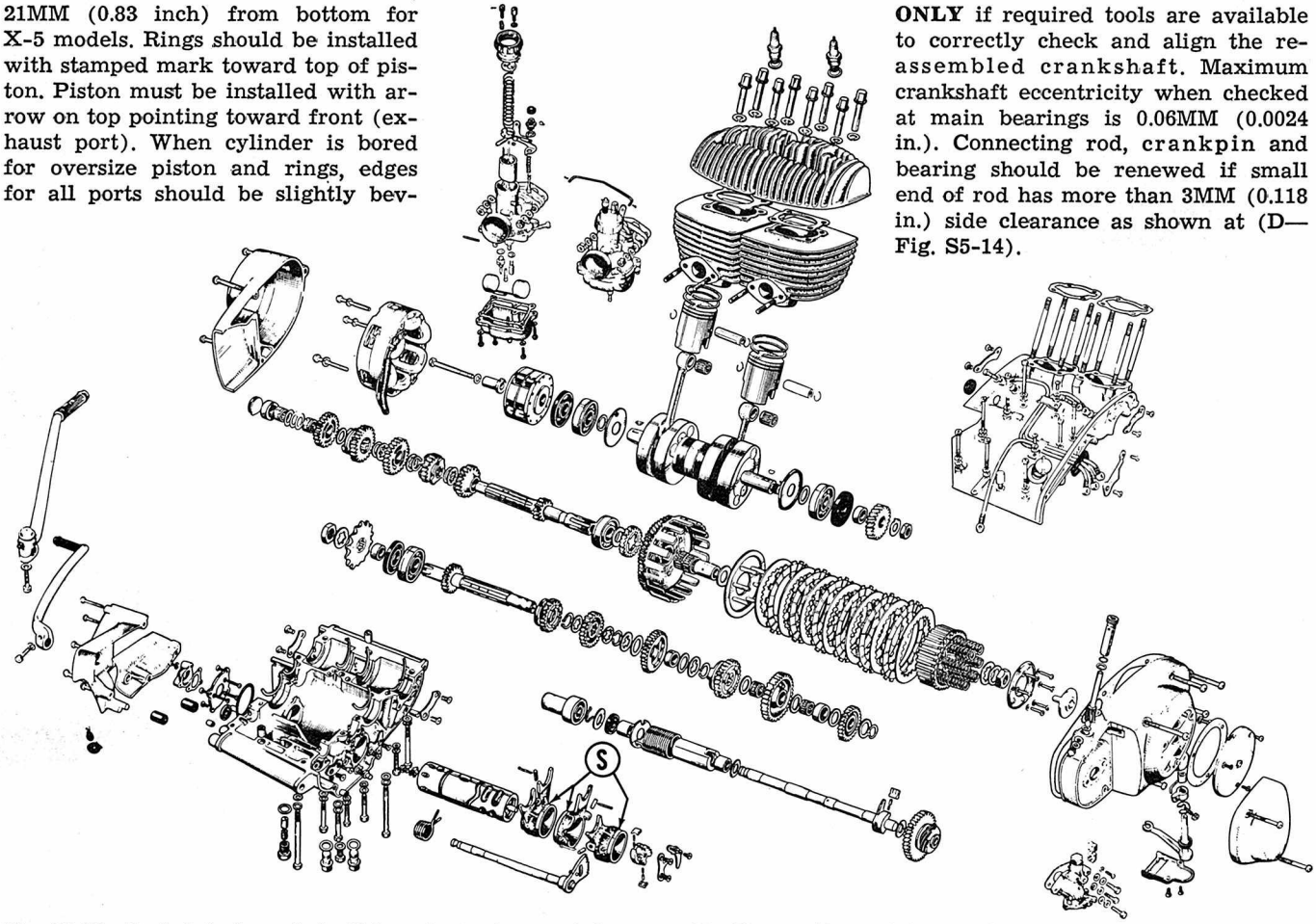
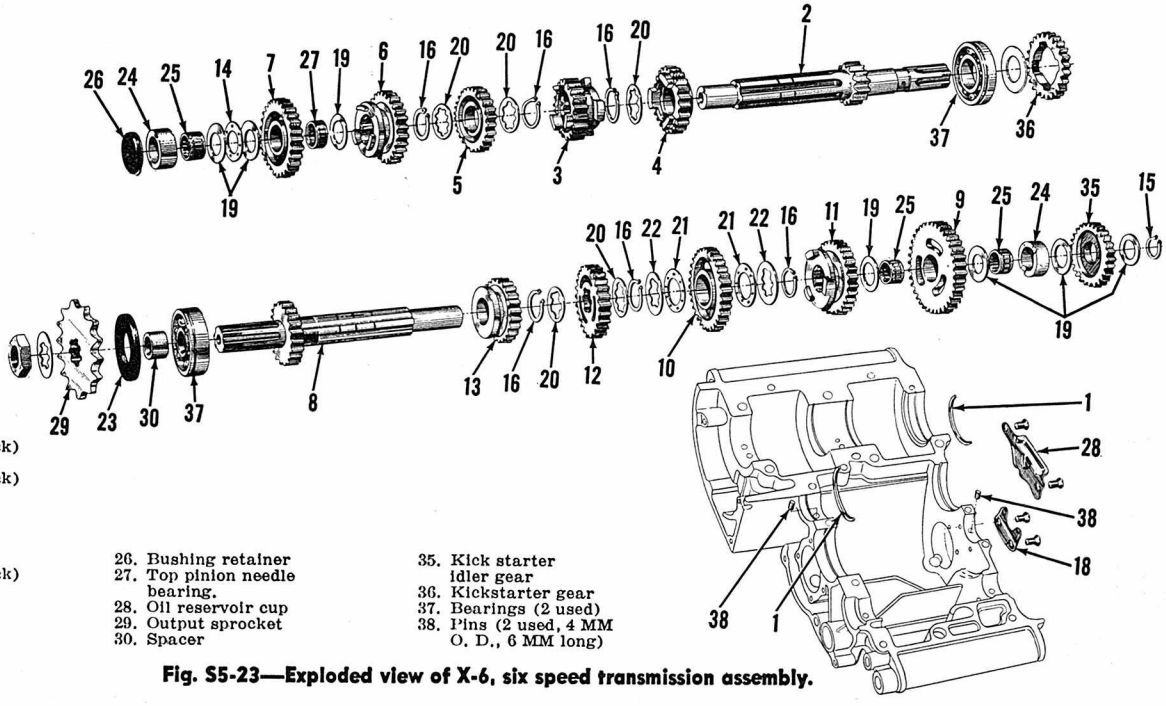


Fig. S5-22—Exploded view of the X-6 engine and transmission assembly. Flanges (S) on shift forks should be on side shown by arrows.



1. Bearing retainer (2 used)
2. Input shaft and first pinion
3. Second pinion
4. Third pinion
5. Fourth pinion
6. Fifth pinion
7. Sixth pinion
8. Output shaft and sixth gear
9. First gear
10. Second gear
11. Third gear
12. Fourth gear
13. Fifth gear
14. Thrust washer
15. Kickstarter snap ring
16. Snap rings (6 used)
18. Bushing retainer
19. Thrust washer (7 used, 1 MM thick)
20. Thrust washer (5 used, 1 MM thick)
21. Second gear inner thrust washer (2 used, 1 MM thick)
22. Second gear outer thrust washer (2 used, 1 MM thick)
23. Oil seal
24. Bushings (2 used)
25. Needle bearings (3 used)
26. Bushing retainer
27. Top pinion needle bearing.
28. Oil reservoir cup
29. Output sprocket
30. Spacer
35. Kick starter idler gear
36. Kickstarter gear
37. Bearings (2 used)
38. Pins (2 used, 4 MM O. D., 6 MM long)

Fig. S5-23—Exploded view of X-6, six speed transmission assembly.

CLUTCH. The multiple disc, wet type clutch is mounted on the right end of the transmission input shaft and can be removed after removing the right side cover. Refer to Fig S5-15 or S5-16 and the following specifications:

X-5 Models

Refer to Fig. S5-15

Friction discs (6)—
Thickness .....0.118 inch
Wear limit .....0.110 inch
Warpage limit .....0.0016 inch

Steel plates (7)—
Thickness .....0.063 inch
Wear limit .....0.059 inch
Warpage limit .....0.0039 inch

X-6 Models

Refer to Fig. S5-16

Friction discs (6)—
Thickness .....0.118 inch
Wear limit .....0.110 inch
Warpage limit .....0.0016 inch

Steel plates (7)—
Thickness .....0.063 inch
Wear limit .....0.059 inch
Warpage limit .....0.0039 inch

Clutch springs (10)—
Free length .....1.87 inches
Minimum limit .....1.79 inches

If side play of clutch drum (1—Fig. S5-15 or S5-16) exceeds 0.3MM (0.0118 in.), spacer (2) can be shortened on a hone to provide clutch drum with 0.1-0.25MM (0.0039-0.0098 in.) side play. On X-5 models, the clutch springs (10—Fig. S5-15) should be screwed into hub (5) until flush with back side. Marks on pressure plate (8) and hub (5) should be aligned as shown in Fig. S5-17. On all models, primary drive gears should be renewed if backlash exceeds 0.0059 inch. Standard backlash is 0.0006-0.0027 inch. Clutch hub nut should be torqued to 31 Ft.-Lbs. Adjustment of clutch controls is outlined in a previous paragraph in MAINTENANCE section.

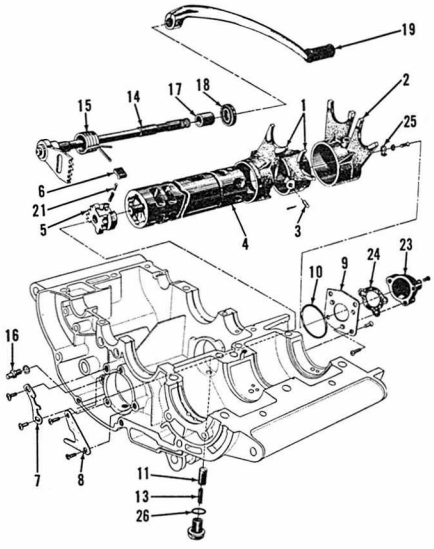


Fig. S5-24—Exploded view of six speed gear shifter assembly used on X-6 models.

1. Low speed shift forks (2 used)
2. High speed shift fork
3. Guide pins (3 used)
4. Shifter cam (drum)
5. Shifter pawl holder
6. Shifter pawls (2 used)
7. Shifter cam guide plate
8. Shifter cam side plate
9. Shifter cam retainer
10. Gasket
11. Detent plug
13. Spring
14. Shifter shaft
15. Return spring
16. Shift arm stop pin
17. Buffer
18. Oil seal
19. Shift pedal
21. Shift pawl plunger
23. Neutral indicator switch
24. Gasket
25. Neutral indicator switch contact

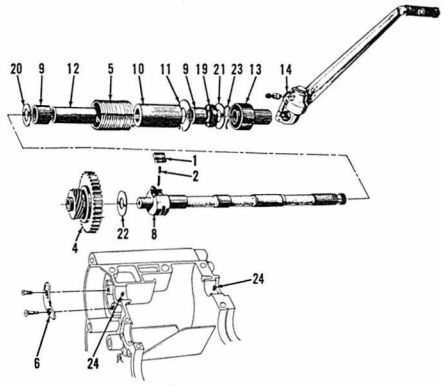


Fig. S5-25—Exploded view of kick starter assembly used on X-6 model.

1. Kickstarter pawl
2. Plunger
4. Kickstarter gear
5. Return spring
6. Stop plate
8. Kickstarter shaft
9. Bushings (2 used, 16 MM I. D.)
10. Spring guide
11. Thrust washer (1.2 MM thick)
12. Spacer
13. Buffer
14. Kickstarter pedal
19. Oil seal
20. Thrust washer (1.0 MM thick)
21. Thrust washer (1.6 MM thick)
22. Thrust washer (1.5 MM thick)
23. Snap ring
24. Pins (2 used, 4 MM O. D., 6 MM long)

CRANKCASE AND GEARBOX. The crankshaft and transmission parts can be removed after the crankcase halves are separated.

To separate the crankcase halves, it is necessary to remove the engine from the frame. Remove cylinders, pistons, engine side covers, alternator assembly and clutch assembly. Remove the screws attaching crankcase halves together (Fig. S5-19 or Fig. S5-20) and lift off the top half. Gears and shafts should remain in place in the lower half. Refer to Figs. S5-21 and S5-22.

When assembling, make certain that mating surfaces of crankcase halves are perfectly clean and flat. Apply a thin coat of "Suzuki Seal" or equivalent to mating surface of top half. No gasket is used and nicks, burrs, old sealer, or uneven application of new sealer may cause leaking.

SPEED TUNING

A kit is available from Suzuki to improve performance in X-6 and TC 250 models. The following recommendations and specifications may be applied to standard models if an increase in horsepower is desired. Any modification of standard parts or installation of performance parts will void the manufacturers warranty.

SPARK PLUG AND IGNITION. NGK racing type spark plugs are recommended by Suzuki. Heat range

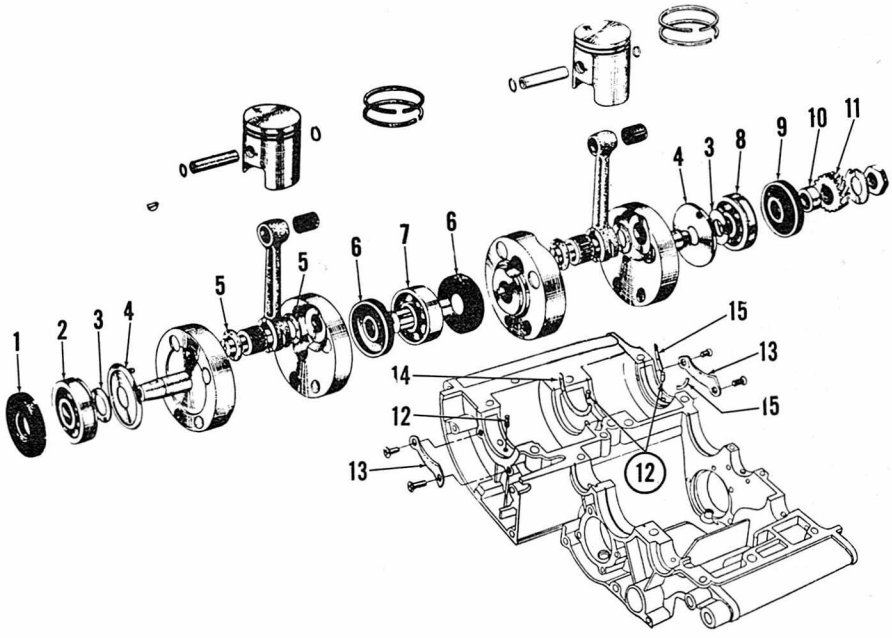


Fig. S5-26—Exploded view of X-6 crankshaft assembly.

1. Left side seal
2. Left side main bearing
3. Thrust washer (2 used, 1.0 MM thick)
4. Oil guide plate (2 used)
5. Connecting rod thrust washers (4 used, 1.0 MM thick)
6. Center seals (2 used)
7. Center main bearing
8. Right side main bearing
9. Right side seal
10. Spacer (11MM thick)
11. Crankshaft gear
12. Guide pins (3 used, 4 MM O. D. 13.8 MM long)
13. Seal retainers (4 used)
14. Seal retainers (2 used)
15. Bearing retainer (2 used)

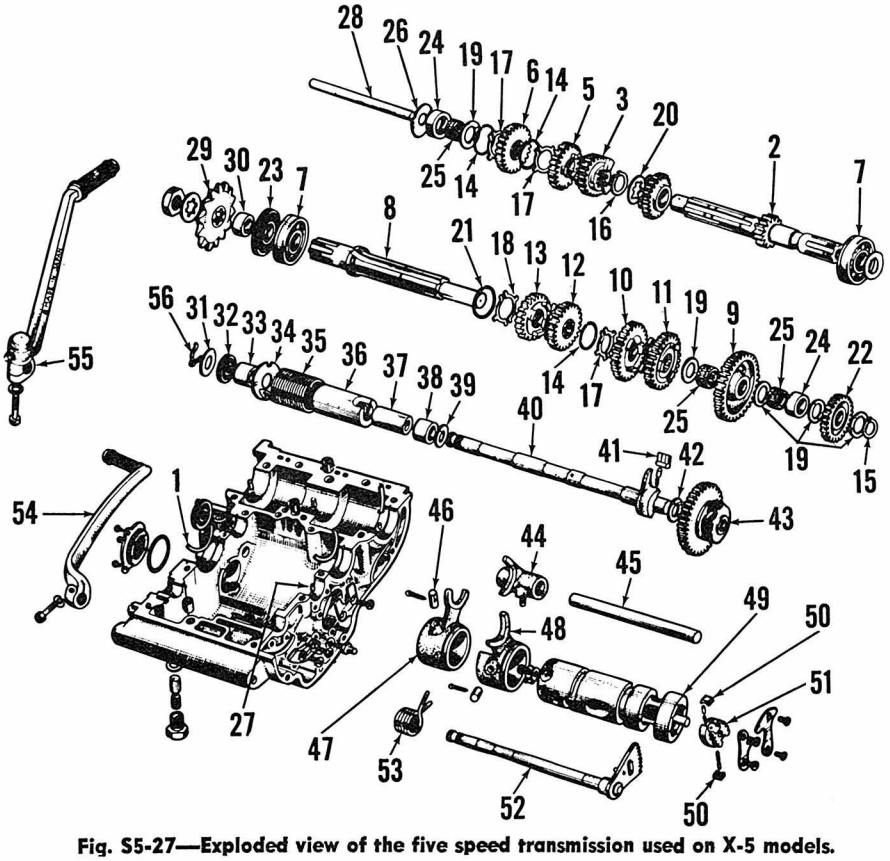


Fig. S5-27—Exploded view of the five speed transmission used on X-5 models.

1. Bearing retainers (2 used)
2. Input shaft and first pinion
3. Second pinion
4. Third pinion
5. Fourth pinion
6. Fifth pinion
7. Bearings
8. Output shaft
9. First gear
10. Second gear
11. Third gear
12. Fourth gear
13. Fifth gear
14. Snap rings
15. Snap ring
16. Snap ring
17. Knock rings (small)
18. Knock ring (large)
19. Thrust washers
20. Thrust washer
21. Snap ring
22. Kick starter idler gear
23. Oil seal
24. Bushings
25. Needle bearings
26. Bushing retainer
27. Pins
28. Clutch rod
29. Output sprocket
30. Seal collar
31. Washer
32. Oil seal
33. Bushing
34. Return spring thrust washer
35. Return spring
36. Spring guide
37. Spacer
38. Bushing
39. Washer
40. Kick-starter shaft
41. Pawl assembly
42. Washer
43. Kick starter gear
44. Shift fork
45. Shift rail
46. Guide pin
47. Shift fork
48. Shift fork
49. Shift drum
50. Ratchet pawls, springs and plungers
51. Shift ratchet
52. Shift shaft
53. Return spring
54. Shift pedal
55. Kick starter pedal
56. Snap ring

of plug should be between a NGK type B-8HN and a B-11HN.

Ignition timing should be set at 25 degrees BTDC (0.112 inch) when engine is modified for road racing, flat track or drag racing. With engine modified for TT or scrambles, set ignition timing at 27 degrees BTDC (0.142 inch) same as standard.

CARBURETORS. The X-6 Motocross Kit is equipped with two VM 26 carburetors. A #130 main jet, 4 F 6 jet needle and an 0-0 needle jet are installed.

When the VM26 carburetors are used for road racing the following specifications may be used for initial settings:

Main jet .....#170
Needle jet N-6
Jet needle .....4 DH 5
Pilot jet .....#35
Throttle valve .....#2.5
Jet needle clip in second groove from top of needle.

A manifold may be constructed to mount 28 MM carburetors from a TS 250 (Savage). Installation of this unit will aid high RPM power only. Engine will have no slow speed throttle response. Recommended specifications for 28 MM carburetors installed on 250cc twins are as follows:
Main jet .....#135-#125
Jet needle .....5 FJ 9
Pilot jet ..... #30
Needle jet .....P-2 or P-0

LUBRICATION. Standard oil metering system may be used or system may be modified by disconnecting oil pump control cable and allowing pump to operate at idle speed with a 20:1 fuel-oil mixture in the fuel tank. Oil used in fuel should be same type as that used in oil tank. Oil pump must not be removed as it is only source of lubrication for outside crankshaft main bearings.

CYLINDER, PISTON AND CYLINDER HEAD. Standard piston may be used for TT and scrambles. Piston should be sanded next to pin hole on each side to reduce minor diameter by 0.010 inch (0.005 inch off each side). Standard skirt clearance should be used (0.002-0.0024 inch). Engines modified for flat track or road racing should be equipped with Wiseco pistons with 0.02 inch thick piston rings. Sand pistons in same fashion as standard pistons reducing minor diameter by 0.010 inch and cut $\frac{3}{16}$ inch (5 MM) from piston skirt reducing piston height from 2.52 inch (64 MM) to 2.32 inch (59 MM). Ring end gap with Wiesco pistons should be 0.065-0.075 inch.

When modifying for flat track, head should be milled 0.040 inch. When modifying for any other competition application milling of more than 0.016 inch is not recommended. Head gaskets should be fabricated from 0.020 inch copper sheet.

The following cylinder modifications are recommended for TT and scrambles competition: (See Fig. ST5-1)

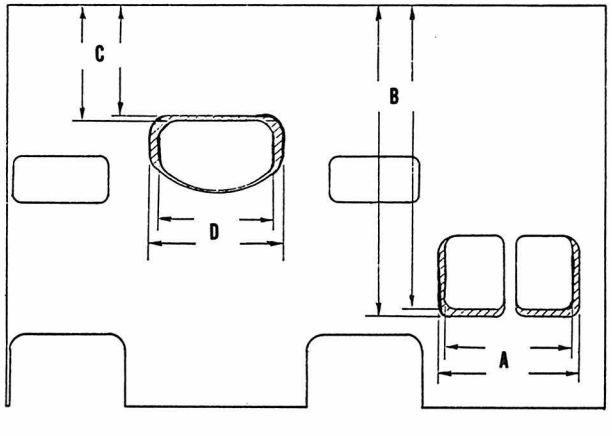


Fig. ST5-1—Areas of cylinder to be modified for TT and scramblers.

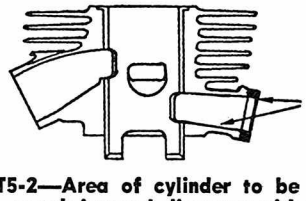


Fig. ST5-2—Area of cylinder to be modified to match internal diameter with larger carburetors.

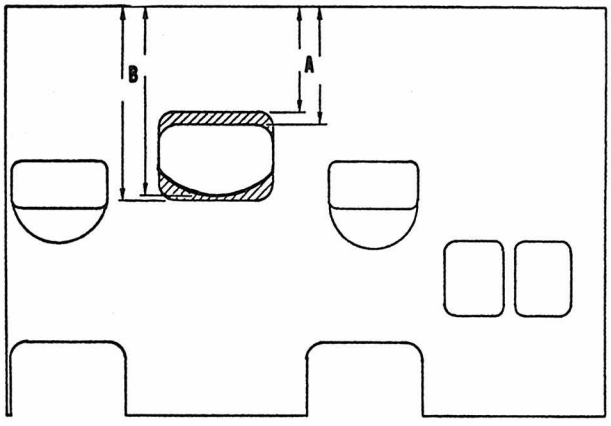


Fig. ST5-3 — Diagram of cylinder modifications for flat track and road racing.

A. Intake port widened to 1.574 inch (40 MM) from 1.417 inch (36 MM) standard width.
B. Intake port lowered to 3.50 inch (89 MM) from top of cylinder. Standard distance is 3.425 inch (87 MM).
C. Exhaust port is raised 1 MM to 1.259 inch (32 MM) from top of cylinder. Standard distance is 1.299 inch (33 MM).
D. Exhaust port widened to 1.496 inch (38 MM) from 1.299 inch (33 MM) standard width.

Taper the exhaust passage for a smooth gas flow. Intake passage should be enlarged to match internal diameter of larger carburetor installed.

Refer to Fig. ST5-3 and the following recommendations for flat track and road racing cylinder modifications:

A. Raise top of exhaust port 0.157 inch (4 MM) to 29 MM from top of cylinder. Standard distance is 33 MM.
B. Square off and lower bottom edge of exhaust port 0.078 inch (2 MM). Modified edge should be 55 MM from top of cylinder. Standard distance is 53 MM.

Width of exhaust port should remain standard as should all other ports. Beginning of intake passage should be enlarged to match internal diameter of larger carburetor.

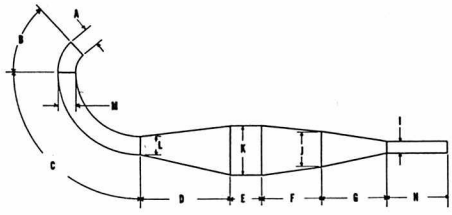


Fig. ST5-4—An expansion chamber of this configuration will yield high RPM power, but will have very little low end torque.

EXPANSION CHAMBER. A high speed, low torque expansion chamber for road racing and flat track applications may be constructed with the following specifications. Use 22 gauge cold rolled steel for construction. (See Fig. ST5-4)

A. 1.574 inch (40 MM)
B. 4.409 inch (112 MM)
C. 7.480 inch (190 MM)
D. 10.236 inch (260 MM)
E. 1.968 inch (50 MM)
F. 4.133 inch (105 MM)
G. 5.905 inch (150 MM)
H. 9.842 inch (250 MM)
I. 0.866 inch (22 MM) 2.716 inch circumference
J. 3.346 inch (85 MM) 10.511 inch circumference
K. 3.937 inch (100 MM) 12.40 inch circumference
L. 2.244 inch (57 MM) 7.04 inch circumference
M. 1.574 inch (40 MM)

SUZUKI 305, 350 AND LATE 250CC TWO CYLINDER MODELS

MAINTENANCE

SPARK PLUG. Recommended spark plug for normal use is the NGK type B-77HC. A Champion type L-62 R is a suitable replacement. Plugs should have an electrode gap of 0.024-0.027 inch. A NGK type B-8H or equivalent is recommended for extended high speed use.

CARBURETORS. All models use two Mikuni sliding valve units. Throt-

MODEL	T250 (X-6R) T250II T250R	T305 TC305	T350 T350II T350R
Displacement—cc	247	305	315
Bore—MM	54	60	61
Stroke—MM	54	54	54
Number of cylinders	2		
Oil-Fuel ratio	Oil-Injection		
Plug gap—inch	0.024-0.027		
Point gap—inch	0.012-0.016		
Ignition timing	Fixed		
Degrees BTDC	24		
Electrical system voltage	12		
Battery terminal grounded	Negative		
Tire size—Front	2.75x18*	3.00x18*	3.00x18
Rear	3.00x18*	3.25x18*	3.25x18*
Tire pressure—Front	23 PSI	23 PSI	23 PSI
Rear	25 PSI	27 PSI	29 PSI
Rear chain free play—inch	¾		
Number of speeds	6		
Weight—Lbs. (approx.)	315	320	325

*T250R Front tire size—3.00x18 T250R Rear tire size—3.25x18
TC305 Front tire size—3.25x18 TC305 Rear tire size—3.50x18
T350R Rear tire size—3.50x18

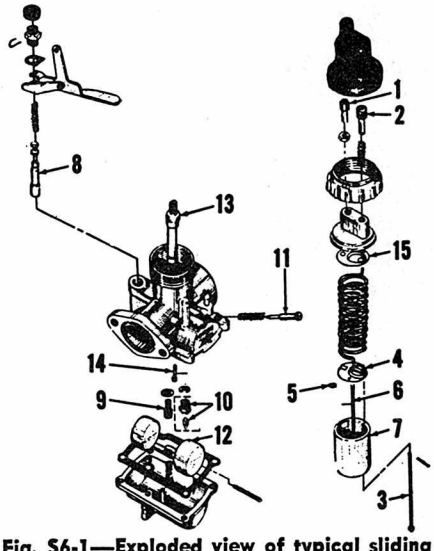


Fig. S6-1—Exploded view of typical sliding valve carburetor used on all models.

1. Throttle cable guide
2. Idle speed adjuster
3. Idle speed rod
4. Retainer
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Inlet valve
11. Idle mixture needle
12. Float
13. Needle jet
14. Pilot jet
15. Spring upper seat

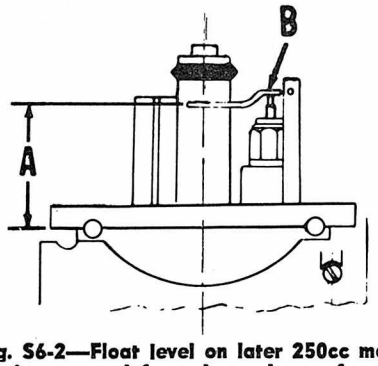


Fig. S6-2—Float level on later 250cc models is measured from the gasket surface to the float arm (A). Proper float level is 0.68 inch.

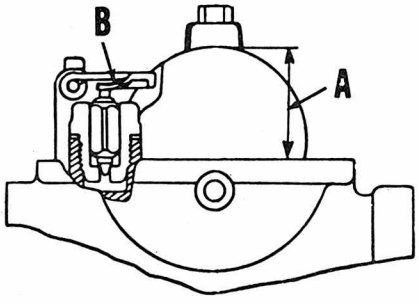


Fig. S6-3—Float level (A) is adjusted by bending tang (B).

tle cable should be adjusted to provide approximately 1/64 inch free play at top of carburetor. Initial setting of pilot air screw (11—Fig. S6-1) is 1½ turns out from a lightly seated position. Refer to Fig. S6-1 and the following standard specifications:

VM 24 SH (T250-X6R)
Main jet (9) .....#87.5
Pilot jet (14) 30
Needle jet (13) N-6
Jet needle (6) .....4 DH 5
Clip (5) in third groove from top of needle (6).

VM 26 SH (T250 II and T250 R)
Main jet (9) .....#110
Pilot jet (14) 25
Needle jet (13) 0-2
Jet needle (6) .....5 CN 3
Clip (5) in third groove from top of needle (6).

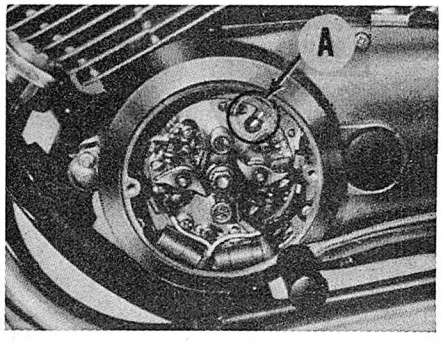
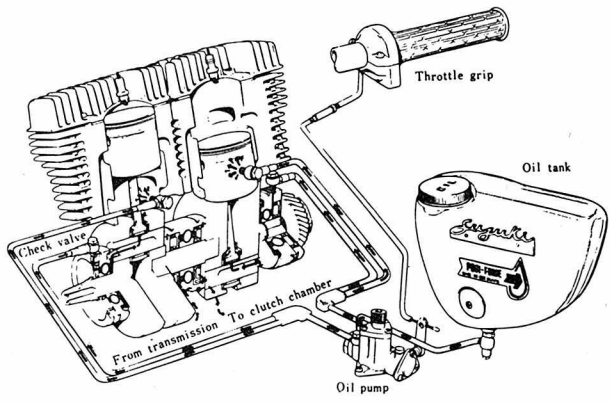


Fig. S6-4 — Timing marks (A) will align when piston is in correct position for ignition. Points should just open as marks align.

Fig. S6-5—View of components used in pressure lubrication system.



VM 32 SH (T305)
Main jet (9) .....#170
Pilot jet (14) 30
Needle Jet (13) .....Q-O
Jet needle (6) .....5 DP 2
Clip (5) in third groove from top of needle (6).

VM 32 SH (T350)
Main jet (9) .....#112.5
Pilot jet (14) 30
Needle jet (13) Q-0
Jet needle (6) .....5 DL 13
Clip (5) in third groove from top of needle (6).

VM 32 SH (T350 II and T350 R)
Main jet (9) .....#112.5
Pilot jet (14) 35
Needle jet (13) P-6
Jet needle (6) .....5 DL 13
Clip (5) in fourth groove from top of needle (6).

Check float levels by just allowing float arm to contact valve needle, spring should not be compressed. Refer to Fig. S6-2 for T250 II and T250 R float level measurement. Float level on these models should be 17.3 MM (21/32 inch). Float level in all other models is measured as in Fig. S6-3. T250 models should be set at 25.75 MM (1 inch); 305 and 350cc models should be set at 27.3 MM ($1\frac{3}{32}$ inch).

Carburetors should be synchronized for best performance. Adjust throttle cables so that both throttle slides begin to move at the same instant.

IGNITION AND ELECTRICAL. The electrical system is equipped with a 12V 5AH battery, an alternator and a full wave rectifier. All AC current is converted to DC for battery charging and other electrical functions.

The rectifier may be inspected with a continuity tester. Current should flow in one direction only from yellow/green to red; from red/green to red; from ground to red/green and from ground to yellow/green. If continuity is discovered in another direction, such as from red/green to ground, unit is faulty.

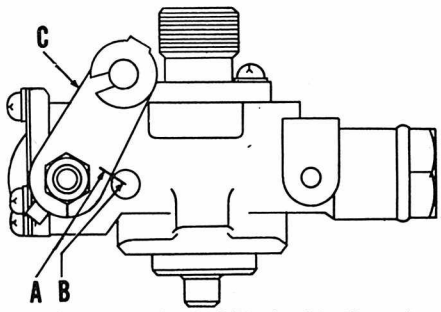


Fig. S6-6—Marks (A&B) should align when throttle is held fully open. Adjust cable that connects to arm (C) if alignment is incorrect.

Maximum ignition point gap should be set at 0.014 inch. Ignition should occur (points just open) as crankshaft reaches 24 degrees BTDC. Piston will be 0.113 inch BTDC at this time and a mark on alternator rotor will align with mark on stator. Red mark on rotor indicates left cylinder timing and black mark indicates right cylinder timing. Timing for right and left cylinder should be checked separately.

LUBRICATION. Gearbox capacity on all models is 1.3 qt. of SAE 20W/40 motor oil. Cavity in crankcase beneath center crankshaft main bearing must be drained separately when changing transmission lubricant.

Engine lubrication is accomplished by an automatic oil metering system. Only oils intended for use in air cooled two cycle engines should be used. Oil is metered in relation to throttle opening and engine speed to outside crankshaft main bearings and to the cylinder walls. Center crankshaft bearings are lubricated by transmission oil (Fig. S6-5).

Oil pump adjustment may be checked by removing plug on right rear of engine and holding throttle wide open. Marks (A&B—Fig. S6-6) should align with throttle wide open. Marks may be aligned by turning oil pump control cable adjusters.

If pump has been removed or allowed to run dry, it will be necessary to bleed the system. Loosen banjo bolt that secures oil line from tank.

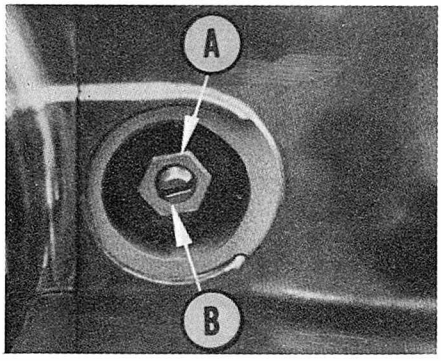


Fig. S6-7—Back screw (B) our ½ turn after it seats lightly and tighten lock nut (A). Adjust clutch control cable for proper free play.

Allow oil to flow until air is no longer present in oil coming from fitting. If air is present in pressure lines, remove bolts that secure lines to pump and use a squirt type oil can to purge lines. Run engine at idle and observe lines to make certain all air has been removed and no leaks are present.

CLUTCH CONTROLS. Turn clutch control cable adjusters until linkage is slack. Remove rubber plug on left side of engine and loosen lock nut (A—Fig. S6-7). Turn adjusting screw (B) until it just contacts push rod (11—Fig. S6-11) and back it out ¼-½ turn from that position. Tighten lock nut and adjust clutch cable adjuster to obtain ⅛ inch free play in clutch lever at pivot.

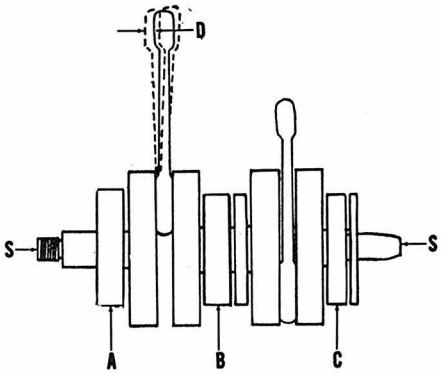


Fig. S6-10—With crankshaft supported on lathe centers at (S), crankshaft eccentricity when measured at points (A, B & C) must be less than 0.0024 inch. Connecting rod shake (D) should be less than 0.118 inch.

SUSPENSION. Front suspension units on all models contain 220cc of SAE 30 motor oil in each tube. Units may be disassembled by clamping outer tube nut (10—Fig. S6-9) in a vise and turning the outer tube (16).

Rear suspension units are not repairable and should be renewed if leaking or damaged.

REPAIRS

CYLINDER, PISTONS AND RINGS. Pistons may be removed without removing engine from frame. Refer to the following repair specifications:

Piston skirt to cylinder clearance
(250cc models) . . 0.0021-0.00256 inch
(305cc models) . . . 0.0026-0.0027 inch
(T350 models) . . 0.0026-0.0030 inch
(T350II and T350 R models) . . . . . 0.0024-0.00286 inch
Maximum cylinder taper or out of round . . . . . 0.002 inch
Ring end gap . . . . . 0.0059-0.014 inch

Pistons are installed with arrow on dome toward front (exhaust side) of engine. Piston rings must be installed with markings toward top. Chrome plated ring belongs in top groove. Later models are equipped with Keystone type pistons and rings. These rings and pistons will not interchange with old style pistons or rings. Head

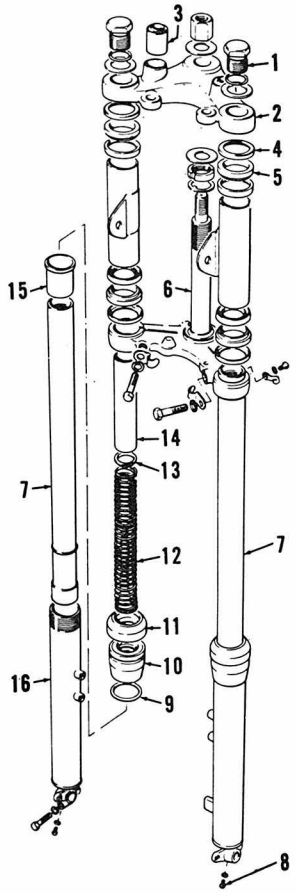


Fig. S6-9—Exploded view of front suspension system used.

1. Fork top bolt
2. Steering head
3. Bushing
4. Bracket seat
5. Bracket cushion
6. Steering stem
7. Inner fork tube
8. Drain plug
9. "O" ring
10. Outer tube nut
11. Oil seal
12. Fork spring
13. Spring guide
14. Spring spacer
15. Slider
16. Outer fork tube

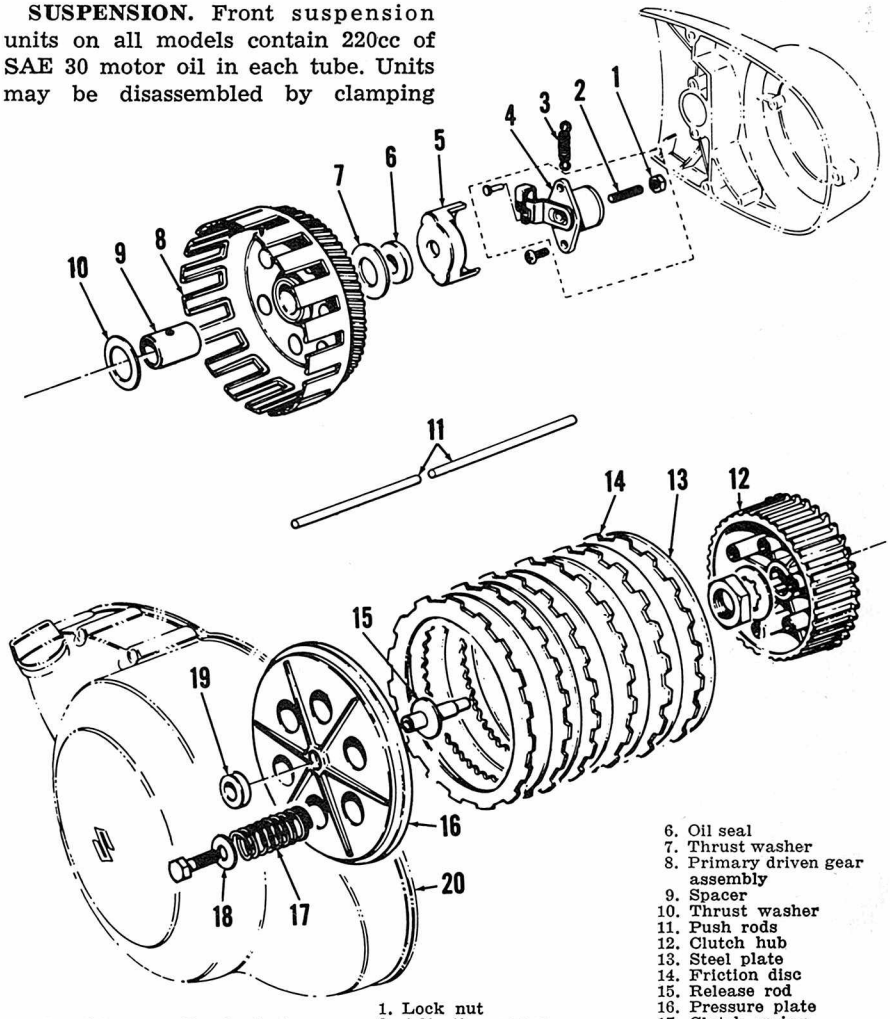


Fig. S6-11 — Exploded view of typical clutch assembly.

1. Lock nut
2. Adjusting screw
3. Return spring
4. Release arm
5. Release screw cover
6. Oil seal
7. Thrust washer
8. Primary driven gear assembly
9. Spacer
10. Thrust washer
11. Push rods
12. Clutch hub
13. Steel plate
14. Friction disc
15. Release rod
16. Pressure plate
17. Clutch spring
18. Washer
19. Oil seal
20. Right hand cover

Fig. S6-13—Exploded view of 305cc engine and transmission assembly. Other models are similar with the addition of shifter brak

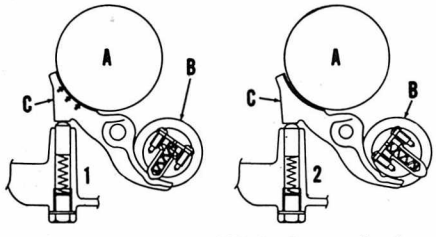
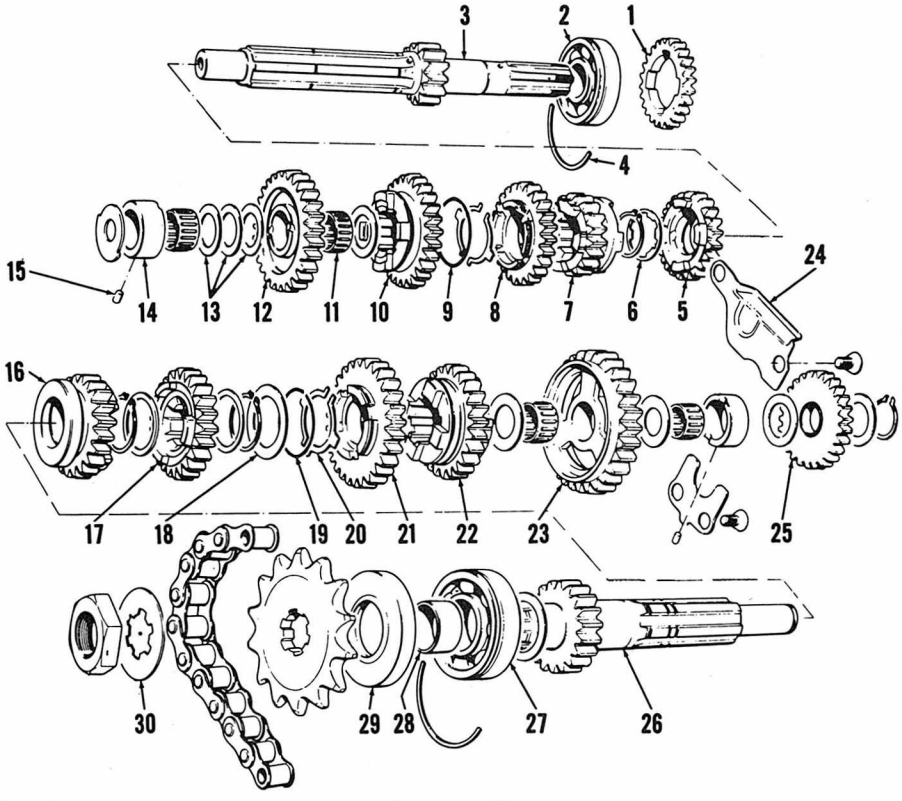


Fig. S6-14—View of shift brake mechanism. Brake pad (C) is held against first gear wheel (A) when shift drum (B) is in neutral position (1). If transmission is in any gear (2), brake will be released.

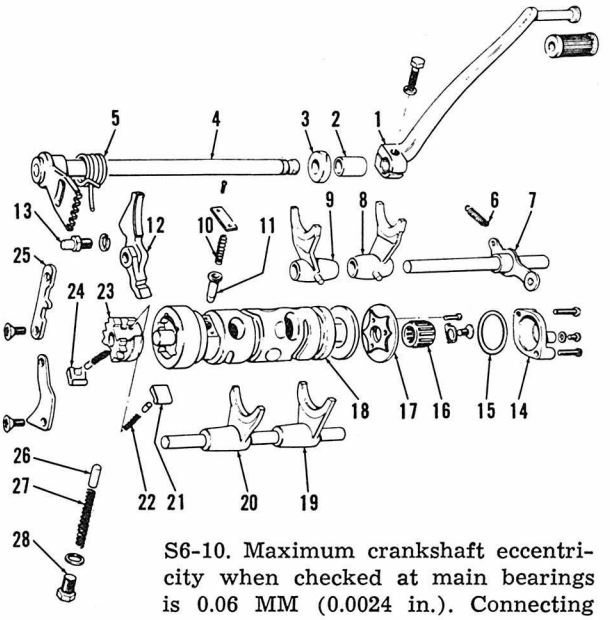


1. Kick start gear
2. Ball bearing
3. Counter shaft
4. Bearing "C" ring
5. Third drive gear
6. Thrust washer
7. Second drive gear
8. Fourth drive gear
9. Gear retaining clip
10. Fifth drive gear
11. Needle bearing
12. Sixth drive gear
13. Thrust washers
14. Shaft bushing
15. Dowel pin
16. Fifth driven gear
17. Fourth driven gear
18. Thrust washer
19. Gear retaining clip
20. Gear knock ring
21. Second driven gear
22. Third driven gear
23. First driven gear
24. Oil reservoir cup
25. Kick idler gear
26. Drive shaft
27. Ball bearing
28. Bushing
29. Oil seal
30. Sprocket tab washer

Fig. S6-15—Exploded view of transmission assembly used in 250 and 350cc models. Unit in 305 is similar.

Fig. S6-16 — View of shifter mechanism and shift brake used on most units.

1. Shift lever
2. Shift shaft buffer
3. Oil seal
4. Shift shaft
5. Return spring
6. Shift cam stopper spring
7. Shift cam stopper
8. Fifth gear shifting fork
9. Third gear shifting fork
10. Neutral stopper spring
11. Neutral stopper
12. Transmission brake shoe
13. Shifting arm stopper
14. Neutral switch cover
15. "O" ring
16. Needle bearing
17. Shift cam stopper plate
18. Shift cam
19. Fifth drive gear shifting fork
20. Second drive gear shifting fork
21. Shifting pawl
22. Pawl roller spring
23. Shifting driven gear
24. Shifting pawl
25. Shifting cam guide
26. Brake shoe tappet
27. Brake spring
28. Brake spring hole plug



gaskets with ridge pressed in them should be installed with ridge toward head. Pistons are available in standard and three oversizes. Torque head nuts using a cross pattern to 14.5 Ft.-Lbs.

CONNECTING ROD AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Connecting rods, crankpins, rod bearings and center main bearing are removed by pressing crankshaft apart. Crankshaft should be disassembled **ONLY** if required tools are available to correctly check and align the reassembled crankshaft. Refer to Fig. S6-10. Maximum crankshaft eccentricity when checked at main bearings is 0.06 MM (0.0024 in.). Connecting rod, crankpin and bearing should be renewed if small end of rod has more than 3 MM (0.118 in.) side clearance as shown at (D—Fig. S6-10).

CLUTCH. The clutch is a multiplate wet type unit mounted on right side of engine. Standard thickness of friction disc (14—Fig. S6-11) is 0.138 inch. Disc should be renewed if worn to less than 0.126 inch thick. Standard length of clutch springs (17) is 1.51 inch. Springs should be renewed if less than 90% of original length.

CRANKCASE AND GEARBOX. The crankshaft and transmission parts can be removed after crankcase halves are separated.

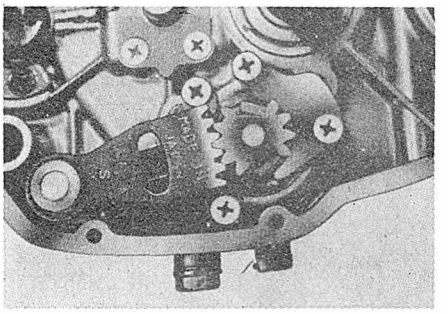


Fig. S6-17—Installation of shift shaft in relation to shift drum gear set.

To separate the crankcase halves, it is necessary to remove the engine from the frame. Remove engine side covers, alternator assembly and clutch assembly. Remove the screws attaching crankcase halves together and lift off the top half. Gears and shafts should remain in place in the lower half.

When assembling, make certain that mating surfaces of crankcase halves are perfectly clean and flat. Apply a thin coat of "Suzuki Seal" or equivalent to mating surface of top half. No gasket is used and nicks, burrs, old sealer, or uneven application of new sealer may cause leaking.

Shifter brake (C—Fig. S6-14) is not used on all models. As shift drum (B) moves to the neutral position, pin moves to contact brake pad and stop low gear wheel (A).

Gear shifter shaft must be installed centered with five tooth side of shift drum gears. See Fig. S6-17.

SUZUKI 500CC TWIN CYLINDER

	TITAN T500 T500II T500 III T500 R
MODEL	
Displacement—cc	492
Bore—MM	70
Stroke—MM	64
Number of cylinders	2
Oil-Fuel ratio	Oil Injection
Plug gap—inch	0.018-0.020
Point gap—inch	0.012-0.016
Ignition timing	Fixed
Piston position BTDC—inch	0.133
Electrical system voltage	12
Battery terminal grounded	Negative
Tire size—Front	3.50x19
Rear	4.00x18
Tire pressure—Front	23 PSI
Rear	27 PSI
Rear chain free play—inch	¾
Number of speeds	5
Weight—Lbs. (approx.)	408

MAINTENANCE

SPARK PLUG. Recommended spark plug for normal operation is an NGK type B-77HC or a Champion type L 62 R. Plugs should have an electrode gap of 0.018-0.020 inch.

CARBURETORS. Two Mikuni sliding valve carburetors are used on all models. Refer to Fig. S7-1 and the following carburetor specifications for appropriate model:

T500 (VM 34 SH)

Main jet (7) .....#410
Needle jet (6) Q-5
Jet needle (3) .....5 DP 2
Pilot jet (8) .....#25
Throttle valve (5) 2.5
Clip (2) in second groove from top of needle (3).

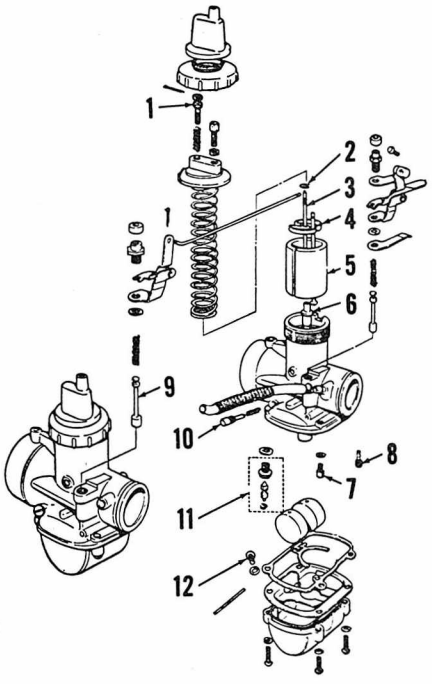


Fig. S7-1 — Exploded view of carburetor used on 500 Suzuki.

1. Throttle stop screw
2. Jet needle clip
3. Jet needle
4. Spring seat
5. Throttle slide
6. Needle jet
7. Main jet
8. Pilot jet
9. Starter plunger
10. Pilot air screw
11. Fuel valve
12. Float chamber drain plug

Float level (See Fig. S7-3)
Black floats ....30 MM ($1\frac{3}{16}$ inch)
Brass floats ....29 MM ($1\frac{5}{32}$ inch)

T500 II, T500 III and T500 R (VM 32 SC)

Main jet (7) .....#150
Needle jet (6) LP-4
Jet needle (3) .....5 FP 8
Pilot jet (8) .....#30
Throttle valve (5) 2.5
Clip (2) in third groove from top of needle (3).
Float level (See Fig. S7-3) 27.5 MM ($1\frac{1}{16}$ inch)

Throttle cables should have approximately 1 MM ($\frac{1}{32}$ inch) free play at top of carburetor. Both throttles should start to move at same instant. Carburetors should be synchronized to perform properly. Turn pilot air screw (A—Fig. S6-2) in until lightly seated and back out 1¼ turns. Start engine and allow it to reach operating temperature. Stop engine, remove one spark plug wire, restart and adjust throttle stop screw (B—Fig. S7-2 or 1—Fig. S7-1 on early models) until engine is running steadily at slowest possible speed. Turn pilot air screw (A) until smoothest possible operation is attained. Screws should not need to be turned more than one full turn in either direction. Adjust opposite carburetor in like manner and start engine with both plug wires connected. Turn both throttle stop screws an equal amount to obtain idle speed of 1200-1500 RPM.

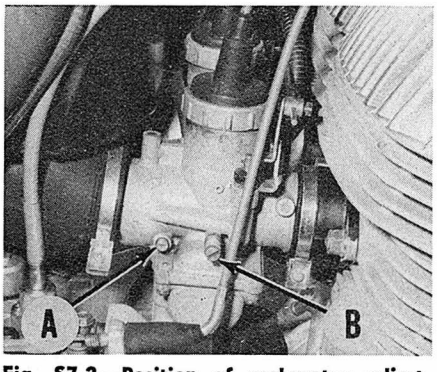


Fig. S7-2—Position of carburetor adjustments on later models.

A. Pilot air screw B. Throttle stop screw

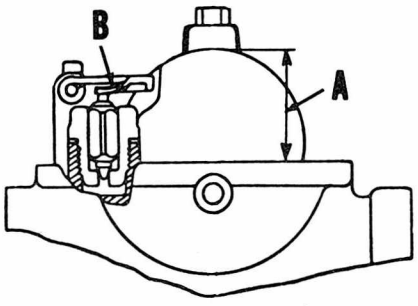


Fig. S7-3—Float level (A) may be adjusted by bending tang (B).

Float level (A—Fig. S7-3) is adjusted on all models by bending tang (B). Measurement is taken by inverting carburetor body and checking distance from bottom of floats to gasket surface of carburetor body (gasket removed).

IGNITION AND ELECTRICAL. A 12 volt 7 AH battery is used in the system. An alternator mounted at left end of crankshaft is used to produce current, all of which is channeled directly to rectifier. All electrical functions are DC operated.

The voltage regulator, mounted beneath the seat, may be inspected with an ohmmeter after disconnecting unit. Resistance between orange and black/white wire should be 1000 ohms. Continuity in either direction between black/white and red/green wire will mean unit is defective and must be renewed. CAUTION: Make certain that regulator is installed correctly before attempting to start engine. Reverse polarity will damage battery and regulator. Make certain that regulator is well grounded.

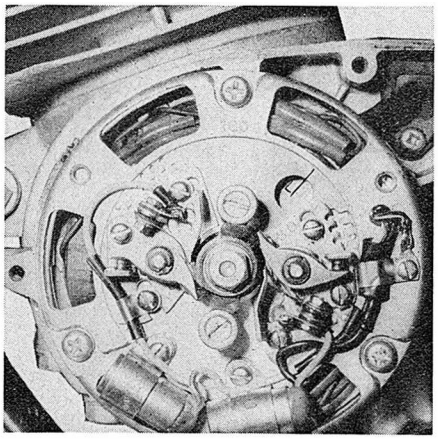


Fig. S7-4—"L" mark on rotor should align with mark on base plate as ignition points for left cylinder open.

The rectifier, also mounted beneath seat, may be inspected with an ohmmeter or continuity tester. Place test leads on the following wire combinations in both directions. Current should flow in one direction and not in the other: yellow/green and red; red/green and red; ground and red/green; ground and yellow/green. If continuity is found in any other direction, such as red and ground, unit is defective.

Maximum point gap should be set at 0.012-0.016 inch. Ignition should occur (points just open) at 24 degrees BTDC. Piston will be 0.133 inch (3.40 MM) BTDC at this time.

"L" mark on alternator rotor should align with timing mark on stator when left piston is in position for ignition. (Fig. S7-4). NOTE: Early models used a red mark on rotor to indicate left cylinder timing and a blue mark to indicate right cylinder timing. Ignition for right cylinder should occur as "R" mark on rotor aligns with mark on stator. Breaker base plates are adjusted separately. Clockwise movement will advance ignition timing.

LUBRICATION. Gearbox should be drained and refilled every 4000 miles with 1.3 qt. of SAE 20W/40 motor oil. Oil should be maintained at level of plug (P—Fig. S7-5).

Engine lubrication is done by an automatic oil metering system. Oil tank should be serviced with an oil intended for use in air cooled two

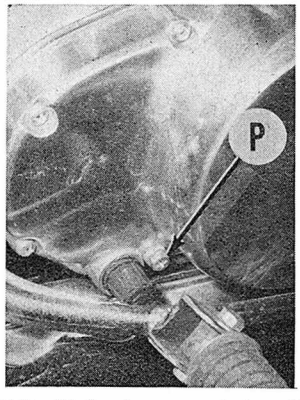


Fig. S7-5—Maintain transmission fluid at level of plug (P).

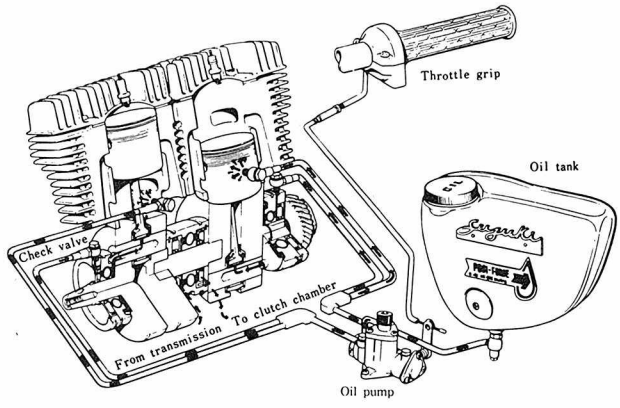


Fig. S7-6 — Diagram of automatic lubrication system used.

cycle engines and should never be allowed to run dry.

The oil pump, mounted on right top side of engine, meters oil in relation to throttle opening and engine RPM to the outside crankshaft main bearings and the cylinder walls (Fig. S7-6).

Use oil pump cable adjuster to align marks (A & B—Fig. S7-7) when throttle is held fully open.

If oil pump has been removed or allowed to run dry, system must be bled of all air. Loosen the banjo bolt that secures inlet line from oil tank to pump and allow oil to flow until air bubbles are no longer present. Air may be expelled from pressure lines by running engine at idle and holding pump control arm to full on position or by disconnecting pressure lines and using a squirt can to purge them.

CLUTCH CONTROLS. Slide rubber cover (C — Fig. S7-8) up cable and turn adjuster until slack is just taken up in cable. Remove adjusting screw cover and loosen lock nut (A). Turn adjusting screw (B) to obtain $\frac{5}{32}$ inch free play in clutch lever pivot. Make certain that lock nuts on adjusting screw and cable adjuster are tight.

SUSPENSION. Each front suspension unit contains 220cc of SAE 30 motor oil. Fork oil should be renewed every 2000 miles and is drained by removing oil drain plug (P—Fig. S7-9).

Front forks may be disassembled by clamping the outer tube nut (8—Fig. S7-10) in a vise and turning the outer tube. Care should be taken to prevent damage to nut in vise (Fig. S7-11).

Rear suspension units may be adjusted to three separate spring tensions by turning cam ring (Fig. S7-12). Both units should be adjusted to same setting. Rear suspension units are not repairable and should be renewed if leaking or damaged.

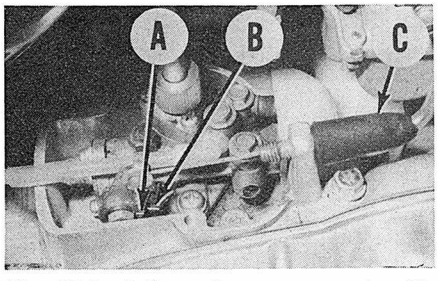


Fig. S7-7—Adjust oil pump control cable so that marks (A&B) align at full throttle

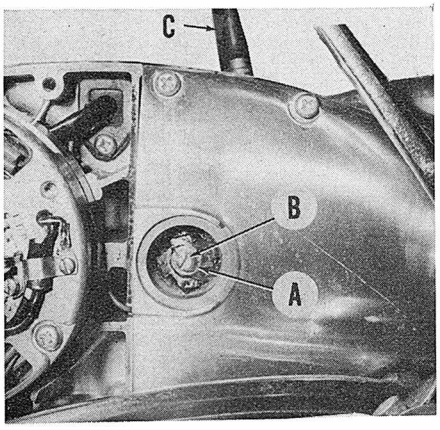


Fig. S7-8—After adjusting clutch cable to zero slack, turn adjuster (B) to obtain 5/32 inch free play in clutch lever pivot.

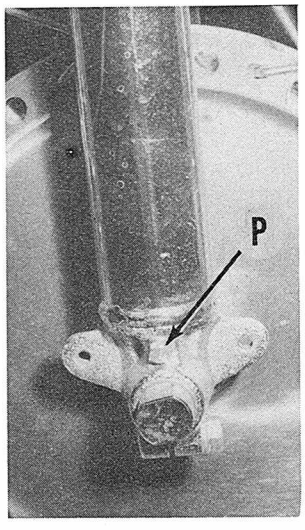


Fig. S7-9 — Front suspension units are drained by removing plug (P), then compressing and releasing forks.

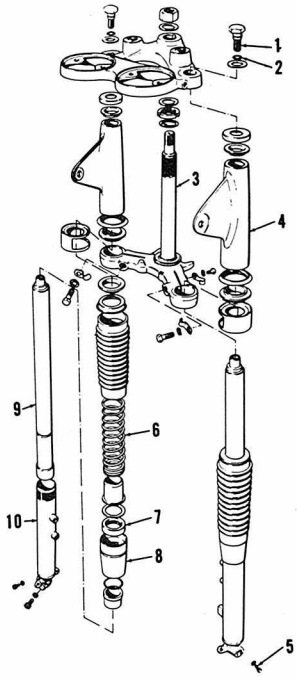


Fig. S7-10—Exploded view of T500 front fork assembly.

1. Fork top bolt
2. "O" ring
3. Steering stem
4. Head lamp bracket
5. Drain plug
6. Fork inner spring
7. Oil seal
8. Outer tube nut
9. Inner tube
10. Outer tube

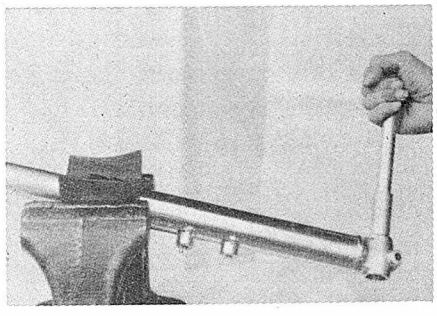


Fig. S7-11—A discarded tire inner tube will provide ample protection for outer tube nut in vise.

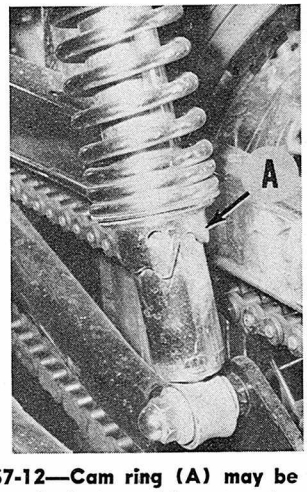


Fig. S7-12—Cam ring (A) may be placed in any of three positions to vary spring tension. Both rings should be adjusted the same.

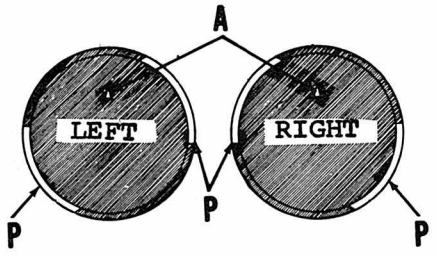
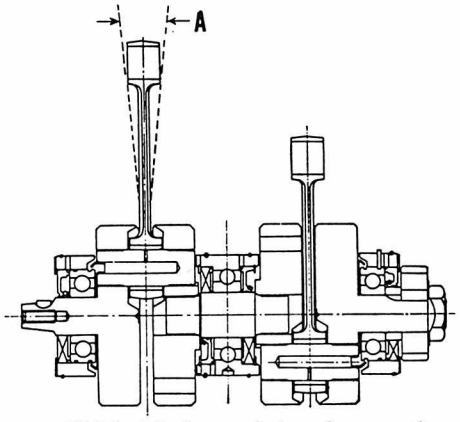


Fig. S7-13—Pistons must be installed with ports (P) and arrows (A) arranged in this manner.



g. S7-14—Maximum shake of connecting rod (A) is 0.118 inch.

REPAIRS

PISTONS, RING AND CYLINDERS. Cylinders and pistons may be removed without dismounting engine from frame. Refer to the following repair specifications:

Standard cylinder bore diameter .....2.7559-2.75618 inch
Piston skirt to cylinder clearance
T500 .....0.0071-0.0075 inch
T500 II, T500 III and T500 R .....0.0026-0.0030 inch
Piston ring end gap ..0.008-0.014 inch
Maximum cylinder taper or out of round .....0.002 inch

Install pistons with arrow (A—Fig. S7-13) to front (exhaust side) of engine. NOTE: Right and left pistons are not interchangeable, install as shown in Fig. S7-13. Pistons used in T500 are not interchangeable with later models. Rings are Keystone type and must be installed with markings on top side. Piston is measured ⅛ inch from bottom at a right angle to pin hole for cylinder clearance check. Head retaining hardware should be torqued evenly using a cross pattern to prevent warpage. Torque bolts to 14.5 foot pounds and nuts to 25 foot pounds.

CRANKCASE AND CRANKSHAFT. It will be necessary to remove engine from frame to disassemble crankcase assembly. Transmission and crankshaft may then be removed after cases are split. A total of 17 bolts are used to hold crankcase halves together, 4

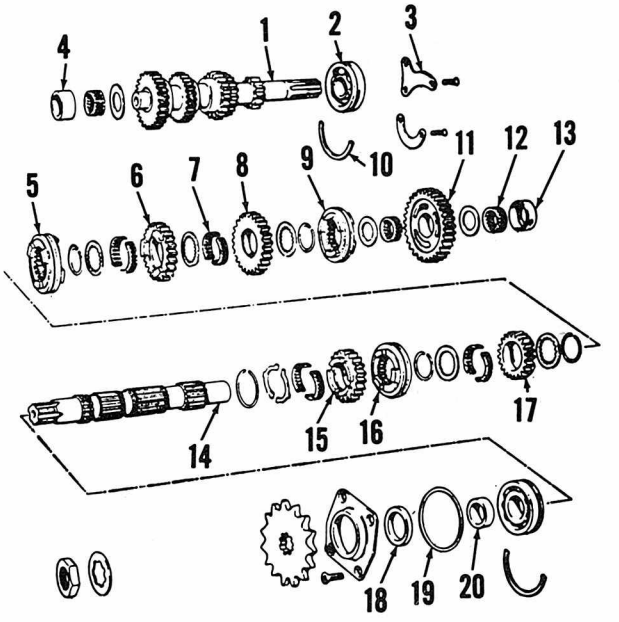


Fig. S7-15 — Exploded view of Titan transmission assembly.

1. Countershaft
2. Countershaft bearing
3. Oil reservoir cap
4. Countershaft bushing
5. Third gear wheel
6. Third gear
7. Needle bearing
8. Second gear
9. First gear wheel
10. Bearing positioning clip
11. First gear
12. Needle bearing
13. Drive shaft bushing
14. Drive shaft
15. Fifth gear
16. Fifth gear wheel
17. Fourth gear
18. Drive shaft oil seal
19. "O" ring
20. Sprocket spacer

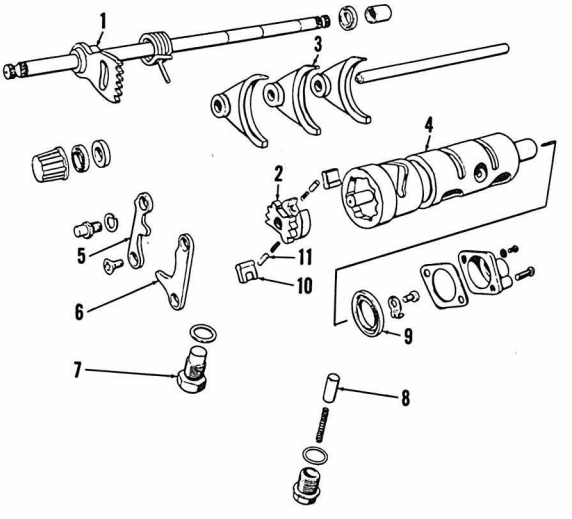


Fig. S7-16 — Component parts of shifter assembly.

1. Shift selector arm
2. Shift pawl holder
3. Shift forks
4. Shift cam
5. Shift cam guide
6. Shift cam side plate
7. Shift guide bolt
8. Shift cam stopper
9. Oil seal
10. Shifting pawl
11. Shifting pawl roller

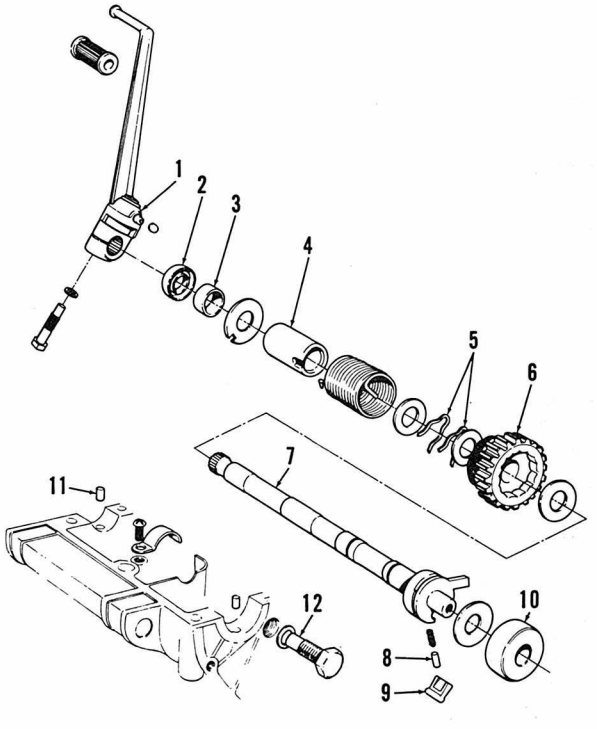


Fig. S7-17 — Exploded view of kickstarter assembly and related parts.

1. Kick start lever
2. Oil seal
3. Spacer
4. Spring guide
5. Retaining clips
6. Starter pinion
7. Starter shaft
8. Pawl roller
9. Starter pawl
10. Oil seal
11. Dowel pin
12. Stopper bolt

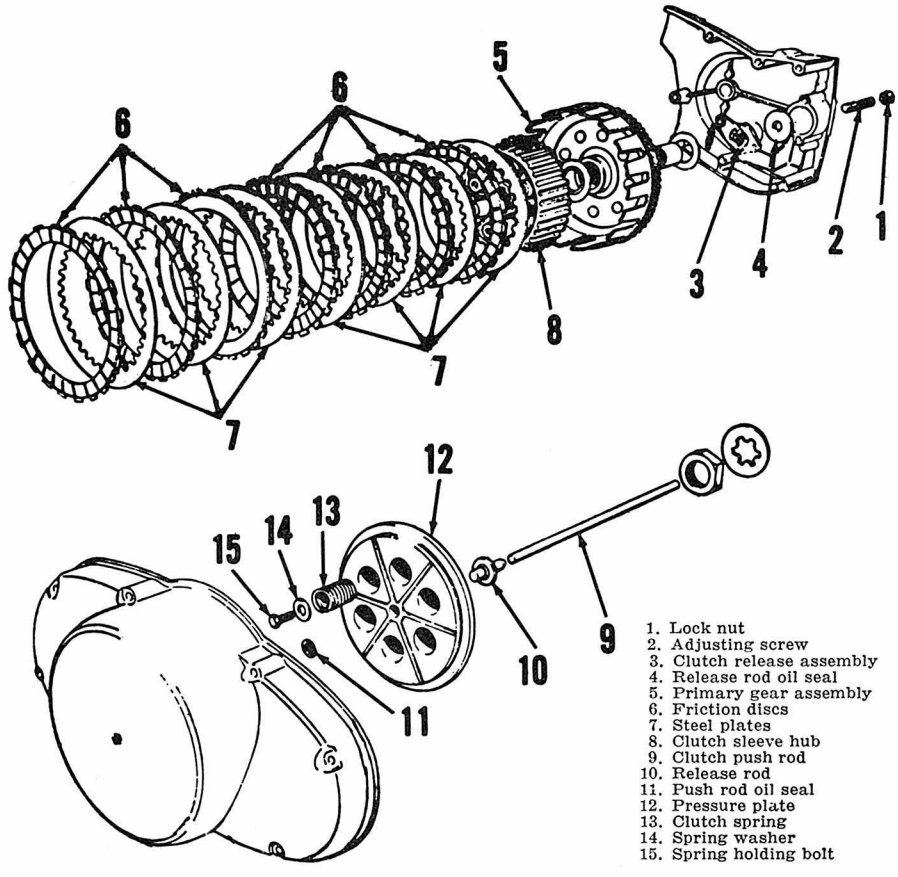


Fig. S7-18—Exploded view of clutch assembly used in the T500 Suzuki.

of which are located on top side of engine. Loosen 4 bolts on top side first then invert engine and remove others. Engine should then be placed on work surface top side up and upper case half lifted away. All transmission components should remain in bottom half.

Crankshaft should be placed between lathe centers and checked for eccentricity Maximum runout is 0.0024 inch. Maximum rod end shake (A—Fig. S7-14) is 0.118 inch.

NOTE: Crankshafts supplied after engine serial number T500-10659 were equipped with larger diameter connecting rods. Outside diameter of the big end of rod was increased from 41.5 MM (1.6338 inch) to 46.5 MM (1.830 inch). If a rebuilt crankshaft is to be installed in an engine manufactured before the modification, the crankcase stuffing rib (area adjacent to connecting rods in crankcase) must be modified by cutting 0.040 inch from each case half.

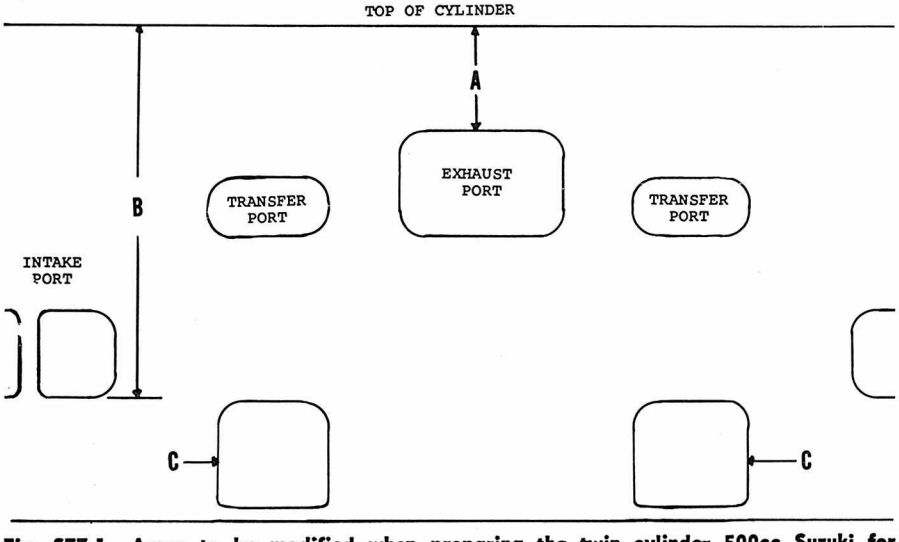


Fig. ST7-1—Areas to be modified when preparing the twin cylinder 500cc Suzuki for competition.

TRANSMISSION. The five speed constant mesh unit may be removed after separating crankcase halves. Gears should be checked for damage and signs of wear. Check shift forks and shift fork grooves for burning. Low gear wheel (9—Fig. S7-15) and third gear wheel (5) are not interchangeable. Parts may be distinguished by 90 degree chamfer of gear engagement dogs of third gear wheel. Drive shaft bushing (13) and countershaft bushing (4) do not interchange. Drive shaft bushing is stamped with a "D". Install gear shifting selector arm (1—Fig. S7-16) facing side of gear shifting pawl holder (2) with five teeth (Not like illustration). Install kickstarter pawl roller (8—Fig. S7-17) with rounded end away from shaft (7).

Case halves should be thoroughly cleaned and a non hardening type sealer used to reassemble crankcases. Torque 6 MM bolts in crankcase to 7 foot pounds and 8 MM bolts to 14 foot pounds.

CLUTCH. The multi disc, wet type unit is operated by a push rod running through the counter shaft. Standard thickness of friction disc (6—Fig. S7-18) is 0.138 inch (3.5 MM). Discs should be renewed if worn thinner than 0.126 inch (3.2 MM). Standard free length of clutch springs (13) is 1.58 inch (40.4 MM). Renew springs less than 1.53 inches (39 MM) in length. Inspect clutch primary gear assembly (5) for axial play and loose rivets. Inspect clutch hub (8) for step wear on splines from steel plates (7).

Clutch hub retaining nut should be torqued to 36 foot pounds.

SPEED TUNING

The following modifications were used on the 500cc Suzuki Daytona road racers. A T500 with the following features incorporated will have more top end power but will lack low end torque and throttle response. An 8200 RPM red line is recommended. Any modification of standard parts or installation of performance parts will void the manufacturers warranty.

SPARK PLUGS. NGK racing (nickel) type plugs are recommended with a B-8HN (hot) being used for warm up and a B-11HN normally being the coldest plug used.

CARBURETORS. Two 32 MM carburetors designed for use on a competition prepared Suzuki 250cc Savage are recommended with #147.5 main jets initially installed. A #30 pilot jet is also recommended.

IGNITION. Ignition should occur when piston is 3.1 MM (0.122 inch) BTDC.

LUBRICATION. Oil used should be type recommended for use in two cycle air cooled engines only. Use a 40:1 mixture of fuel and oil in the fuel tank and disconnect the oil metering pump control cable. Oil metering pump should be left in place and separate lever installed to allow operation of pump independent of throttle. With oil pump control lever in "ON" position, oil pump should be only half way open. With lever in "OFF" position, oil pump should be off. For all normal running pump should be on, however, for very short periods of time the pump may be turned off for a slight boost in speed. CAUTION: Extended operation with pump off will cause engine to seize. Engine should be warmed up with pump in "OFF" position.

PISTON, CYLINDER AND HEAD. Cylinder head should be milled 0.060 inch. Do not leave any sharp edges in combustion chamber.

Cylinder barrel modifications should include removing 5 MM (0.197 in.) from bottom of intake ports (B—Fig. ST7-1) and 5 MM from top of exhaust port (A). Open sides of transfer port cut outs (C) only enough to match transfer channels in top of crankcase. All other dimensions were left unchanged from standard in the factory prepared road racers.

Standard piston should be used. Piston should be lightly sanded in the area adjacent to the pin hole. Do not reduce the minor diameter of the piston by more than 0.0035 inch.

Pistons and cylinders were altered in 1969. Early pistons should only be used with early cylinders and late model pistons should only be used with late style cylinders. Piston to cylinder clearance for 500/5 (1968 model) should be 0.0071-0.0075 inch. Clearance on T500-II and later models should be 0.0026-0.003 inch. Ring end gap should be 0.010-0.020 inch on all models.

EXPANSION CHAMBER. A replica of the expansion chamber used on the Daytona factory road racers may be constructed with the following specifications. Steel sheet 0.040 inch thick was used to fabricate these chambers. See Fig. ST7-2.

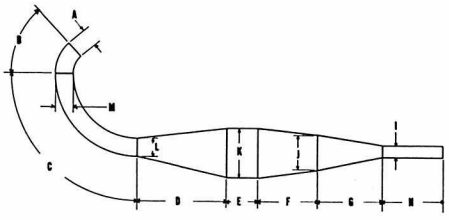


Fig. ST7-2—An expansion chamber will improve the performance of a correctly prepared engine. Refer to text for dimensions of Daytona road racer chamber.

A. 45 MM (1.771 in.)
B. 150 MM (5.90 in.)
C. 275 MM (10.826 in.)
D. 320 MM (12.59 in.)
E. 32 MM (1.259 in.)
F. 150 MM (5.90 in.)
G. 237 MM (9.330 in.)
H 220 MM (8.661 in.)
I. 23 MM (0.905 in.)
J. 86 MM (3.385 in.)
K. 100 MM (3.397 in.)
L. 65 MM (2.559 in.)
M. 49 MM (1.929 in.)

SUZUKI 90CC MODELS

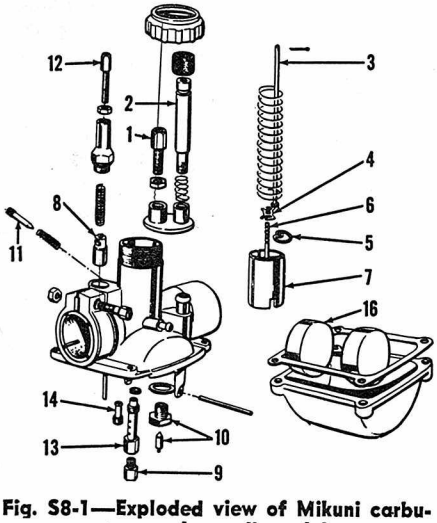


Fig. S8-1—Exploded view of Mikuni carburetor used on all models.

1. Throttle cable guide
2. Idle speed adjuster
3. Idle speed rod
4. Retainer
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Fuel inlet valve
11. Idle mixture needle
12. Starting valve cable guide
13. Needle jet
14. Pilot jet
16. Float

MAINTENANCE

SPARK PLUG. An NGK type B-77 HC or equivalent is recommended for normal riding conditions. Recommended spark plug electrode gap is 0.018-0.020 inch.

MODEL	TS 90 R TS 90	TC 90 R TC 90
Displacement—cc	89	89
Bore—MM	47	47
Stroke—MM	51.8	51.8
Number of cylinders	1	1
Oil-Fuel ratio	Oil-Injection	
Plug gap—inch	0.018-0.020	
Point gap—inch	0.012-0.016	
Ignition timing	Fixed	Fixed
Degrees BTDC	20	20
Electrical system voltage	6	6
Tire size—Front	2.75x18	2.75x18
Rear	2.75x18	3.00x18
Tire pressure—Front	23 PSI	23 PSI
Rear	25 PSI	25 PSI
Rear chain free play—inch	¾	¾
Number of speeds	5	4x2
Weight—Lbs. (approx.)	197	199

CARBURETOR. A Mikuni VM 19 SC is used on all models. Initial setting of idle air screw (11—Fig. S8-1) is 1¼ turns open on TC models and 1½ turns open on TS models. Float level should be 25.1 MM (0.98 inch) on all models and is adjusted by bending tang (B—Fig. S8-2). Refer to Fig. S8-1 and the following standard specifications:

TS 90

Main jet (9) .....#160
Needle jet (13) E-2
Pilot jet (14) 17.5
Jet needle (6) .....5 Q 1
Clip (5) in third groove from top of needle (6).

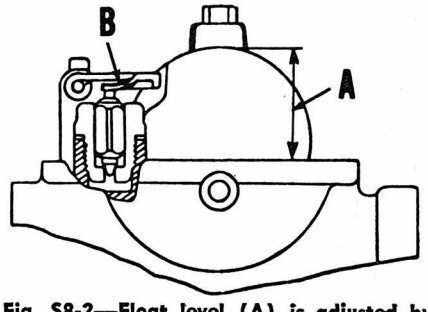


Fig. S8-2—Float level (A) is adjusted by bending tang (B). Level should be 25.1 MM on all models.

TS 90 R and TC 90 R

Main jet (9) .....#180
Needle jet (13) E-0
Pilot jet (14) 17.5
Jet needle (6) ..... 5 F 12

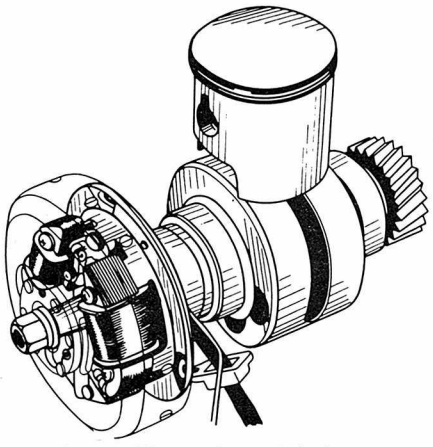


Fig. S8-3 — View of crankshaft magneto used on 90cc Suzuki.

Clip (5) in third groove from top of needle (6).

TC 90

Main jet (9) .....#170
Needle jet (13) E-1
Pilot jet (14) 17.5
Jet needle (6) .....5 F 12
Clip (5) in third groove from top of needle (6).

IGNITION AND ELECTRICAL. A flywheel magneto is mounted at left end of crankshaft. Three coils are located under flywheel; one ignition and two lighting coils. A rectifier is used to convert AC current to DC for lighting and battery charging. The high tension ignition coil is mounted under the seat.

Maximum gap of ignition points should be set at 0.012-0.016 inch. Ignition should occur (points just open) at 20 degrees BTDC (Piston 0.077 inch BTDC). Timing marks (A&B—Fig. S8-4) will align when crankshaft is in correct firing position. Torque flywheel retaining nut to 25 Ft. Lbs.

LUBRICATION. Gearbox capacity is 1.5 pints of SAE 20W/40 motor oil. Oil level may be checked by removing screw just forward of kickstart lever, oil should just be to level of screw when motorcycle is held vertical.

Engine lubrication is accomplished by an automatic oil metering system.

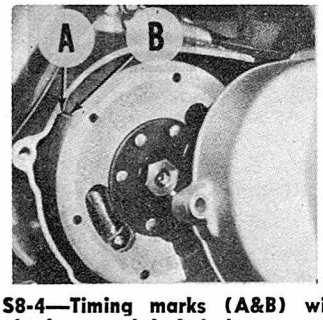


Fig. S8-4—Timing marks (A&B) will be aligned when crankshaft is in correct position for ignition.

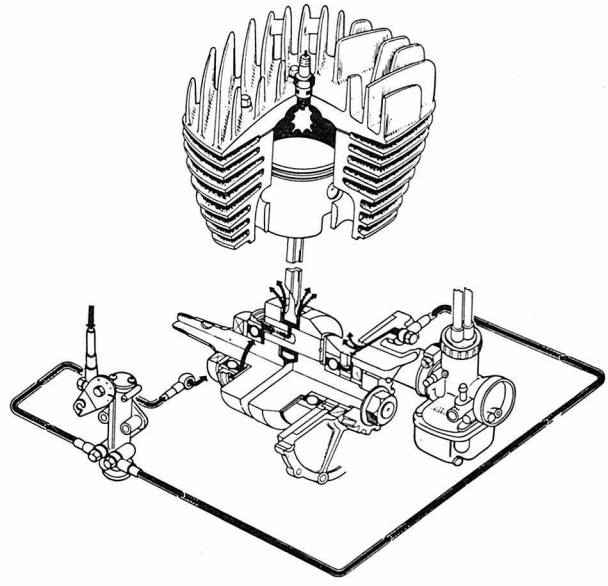


Fig. S8-5 — View of engine lubrication system used on 90cc models. System should never be allowed to run dry.

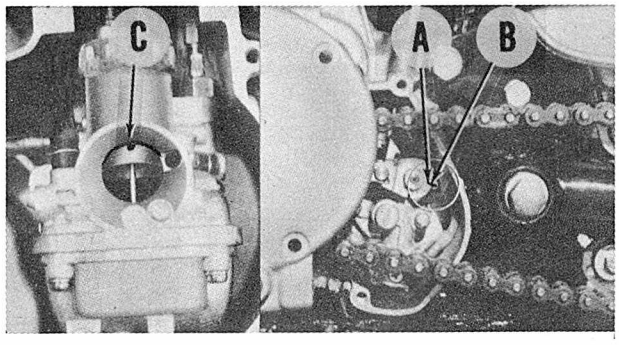


Fig. S8-6 — Remove carburetor cover and observe that index mark on throttle slide aligns with top of bore when marks on oil pump lever and pump body align. Turn cable adjusters to correct.

Oil stored in tank beneath seat is pumped to the rotary valve cover and crankshaft main bearings. Only oils recommended for use in air cooled two cycle engines should be used.

Oil pump adjustment may be checked by removing oil pump cover on left rear of engine and turning throttle grip until index mark on throttle slide of carburetor is aligned with top of throttle bore. See Fig. S8-6. Alignment marks (A&B) on pump should just align at this time. Turn oil pump cable adjusters if alignment is incorrect.

CLUTCH CONTROLS. To adjust clutch, remove cover on left side of engine case and loosen lock nut (1—Fig. S8-7). Turn adjusting screw (4) out until it is loose, then turn screw in until a slight resistance is felt. Turn the adjusting screw out ¼ turn from the point of resistance and tighten lock nut. Adjust clutch cable to obtain ⅛ inch free play in clutch lever pivot on handle grip.

SUSPENSION. Each front suspension unit contains 185cc of SAE 30 motor oil. Oil level in fork tubes may be checked by removing fork top bolt and measuring to fluid level. Proper level is 3.15 inches from top.

Fork inner tubes on TS 90 models should extend 12MM beyond top fork

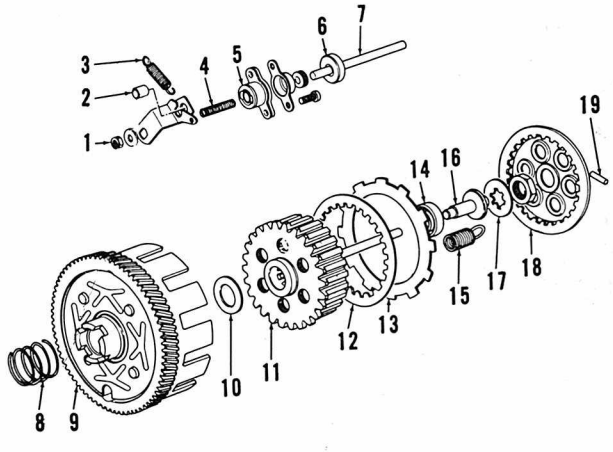


Fig. S8-7 — Exploded view of clutch common to all models.

1. Adjusting screw lock nut
2. End piece
3. Return spring
4. Adjusting screw
5. Release screw
6. Oil seal
7. Push rod
8. Cushion spring
9. Primary gear
10. Thrust washer
11. Clutch hub
12. Steel plate
13. Friction disc
14. Oil seal
15. Clutch spring
16. Push piece
17. Hub washer
18. Pressure plate
19. Clutch spring pin

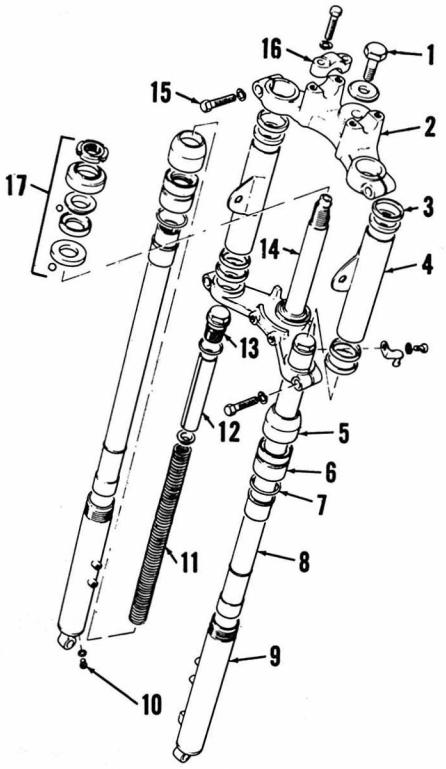


Fig. S8-8—Exploded view of front suspension system used on 90cc Suzuki.

1. Upper bracket fitting bolt
2. Upper bracket
3. Fork cover seat
4. Fork cover
5. Dust cover
6. Outer tube nut
7. "O" ring
8. Inner fork tube
9. Outer fork tube
10. Oil drain screw
11. Fork spring
12. Spring spacer
13. Fork top bolt
14. Steering stem
15. Fork top pinch bolt
16. Handle bar clamp
17. Steering stem bearing set

clamp. See Fig. S8-9. TC 90 fork tubes should be mounted flush.

Rear suspension units are not repairable and should be renewed if leaking or damaged.

REPAIRS

PISTON, CYLINDER AND RINGS. Cylinder and piston may be removed without dismounting engine from frame. Refer to the following repair specifications:

Piston skirt to cylinder clearance—
Recommended ...0.0022-0.0026 inch
Limit .....0.010 inch
Ring end gap .....0.006-0.014 inch
Maximum cylinder taper or
out of round .....0.002 inch
Standard
cylinder bore .....1.850-1.851 inch

Pistons are installed with arrow on dome toward front (exhaust side) of engine. Marks on piston rings go toward top side. Measure piston skirt ¾ inch from bottom at right angle to pin hole for cylinder clearance check. Pistons are available in standard and two oversizes. Torque head retaining nuts to 15-18 Ft.-Lbs. using a cross pattern to prevent warpage.

CONNECTING ROD AND CRANKSHAFT. Engine must be removed from frame and crankcase halves separated to remove crankshaft. Crankshaft eccentricity should be no more than 0.0023 inch. Maximum allowable shake of connecting rod at small end is 0.118 inch. Crankshaft disassembly should only be attempted if proper tools are available to correctly realign parts.

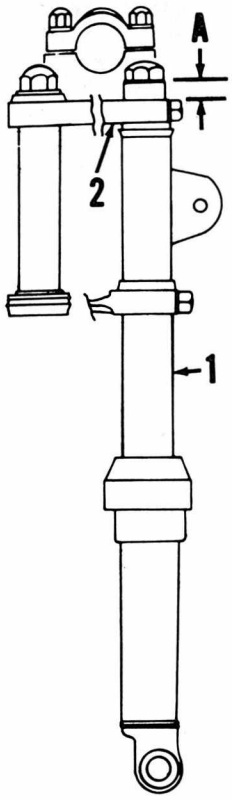


Fig. S8-9—Distance (A) from top side of upper fork bracket (2) to top of inner fork tube (1) should be 12 MM on TS models.

CLUTCH. Clutch may be removed after removing carburetor, kickstarter lever and right side engine covers.

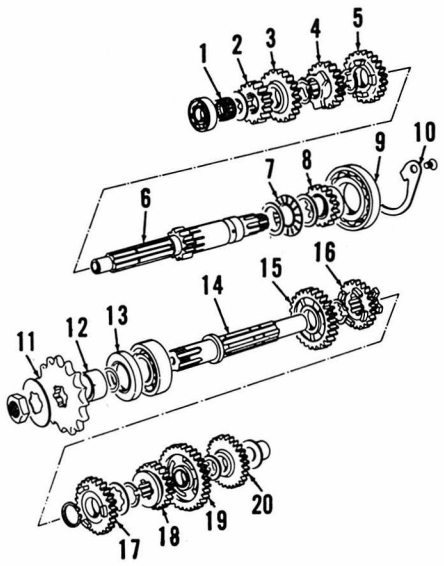


Fig. S8-11—Exploded view of transmission used in TS 90 models.

1. Needle bearing
2. Second drive gear
3. Fourth drive gear
4. Third drive gear
5. Fifth drive gear
6. Counter shaft
7. Kick gear bearing
8. Kick drive gear
9. Ball bearing
10. Bearing fitting plate
11. Drive sprocket
12. Spacer
13. Oil seal
14. Drive shaft
15. Second driven gear
16. Fourth driven gear
17. Third driven gear
18. Fifth driven gear
19. First driven gear
20. Kick idler gear

The clutch is a multi-disc wet type unit with five friction discs and five steel plates. Standard thickness of friction discs (13—Fig. S8-7) is 0.118 inch. Discs should be renewed if less than 0.110 inch in thickness. Steel plates (12) should be renewed if warped more than 0.0039 inch from flat. Standard free length of a clutch spring (15) is 1.189 inch. Springs longer than 1.228 inches should be renewed.

CRANKCASE AND GEARBOX. TS 90 models are equipped with a five speed transmission and TC 90 models

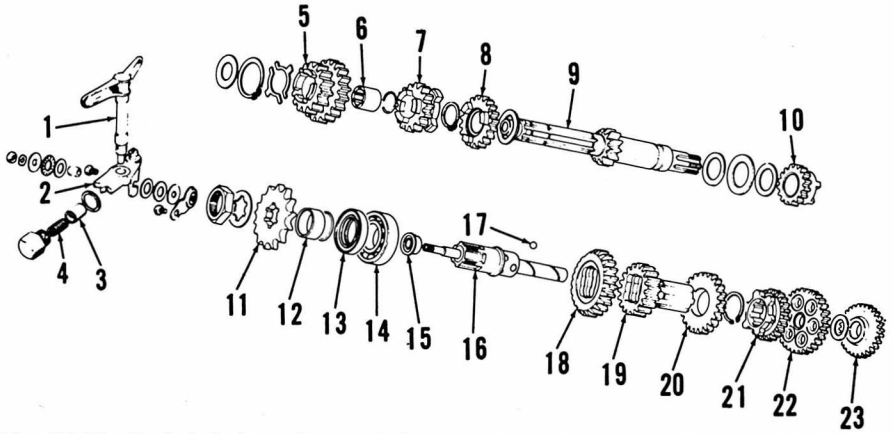


Fig. S8-10—Exploded view of transmission used in TC 90 models. Eight steel balls (17) are used.

1. Selector lever
2. Selector cam
3. Detent
4. Detent spring
5. Fourth drive gear
6. Gear sleeve
7. Second drive gear
8. Third drive gear
9. Countershaft
10. Kick start gear
11. Drive sprocket
12. Sprocket spacer
13. Oil seal
14. Ball bearing
15. Oil seal
16. Drive shaft
17. Steel ball
18. Reduction gear
19. Fourth driven gear
20. Second driven gear
21. Third driven gear
22. First driven gear
23. Kick idler gear

are equipped with a four speed transmission with a high and low speed selector. Inspect gears for broken teeth and worn gear engagement dogs. Inspect shift forks for burned or worn spots.

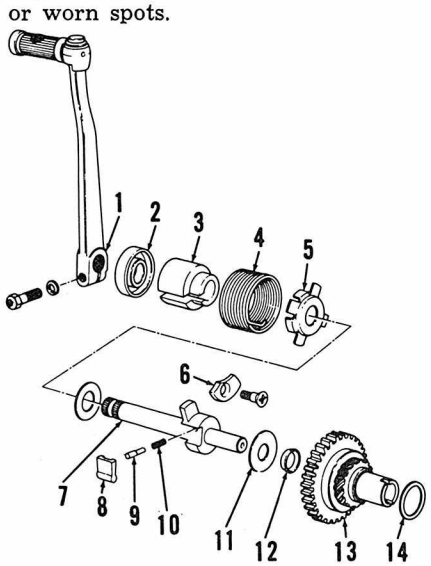


Fig. S8-13—Kickstarter used on TS and TC 90 models. Engine may be started in any gear as long as clutch is disengaged.

1. Kick lever
2. Oil seal
3. Spring holder
4. Spring
5. Spring holder
6. Stopper
7. Kick shaft
8. Starter pawl
9. Pawl pin
10. Pawl spring
11. Washer
12. Oil seal
13. Starter drive gear
14. Washer

SPEED TUNING

The TS 90 Moto-Cross kit available from Suzuki will increase the displacement and power of TS and TC 90 models. The following specifications are for models equipped with the TS 90 Moto-Cross kit. Any modification of standard parts or installation of performance parts will void manufacturers warranty.

SPARK PLUG. A NGK type B-8EN is standard recommendation, however a cooler or hotter plug may be used if plug readings show a need for a different heat range.

CARBURETOR. A Mikuni VM 22 SC is used. The following jet sizes are standard:

Main jet ..... #140
Pilot jet ..... #25
Needle jet 0-0
Jet needle ..... 4 DG 6

Jet needle clip should be in third groove from top of jet needle. Air screw should be 1¼ turns out from a lightly seated position.

IGNITION AND ELECTRICAL. A special magneto is available. If standard magneto is used, all electrical parts not used for ignition may be removed. Ignition timing should be set at 22 degrees BTDC instead of 20 degrees. Piston location will be 0.945 inch BTDC when crankshaft is 22 degrees BTDC.

LUBRICATION. Oil injection pump should be left on motorcycle but control cable is disconnected. Pump pressure at idle setting is enough to lubricate main bearings. A 30 part gasoline to 1 part oil mix should be used in the fuel tank. Oil used in oil tank should be same kind as mixed in fuel.

CYLINDER HEAD. Use of two head gaskets is recommended with kit head. Torque head retaining nuts to 16 Ft. Lbs. using a cross pattern.

PISTON AND RINGS. One piston ring is used and should have 0.006-0.014 inch end gap. After 30 minutes of operation with a new piston, remove cylinder and inspect piston for bright spots. Finish bright spots with #400 emery and break glaze in cylinder. Reassemble, run and recheck until high spots no longer occur on piston.

ROTARY VALVE. Kit rotary valve has a duration of 166 degrees as opposed to a 132 degree duration standard valve. Punch mark on valve hub should be aligned with keyslot in crankshaft.

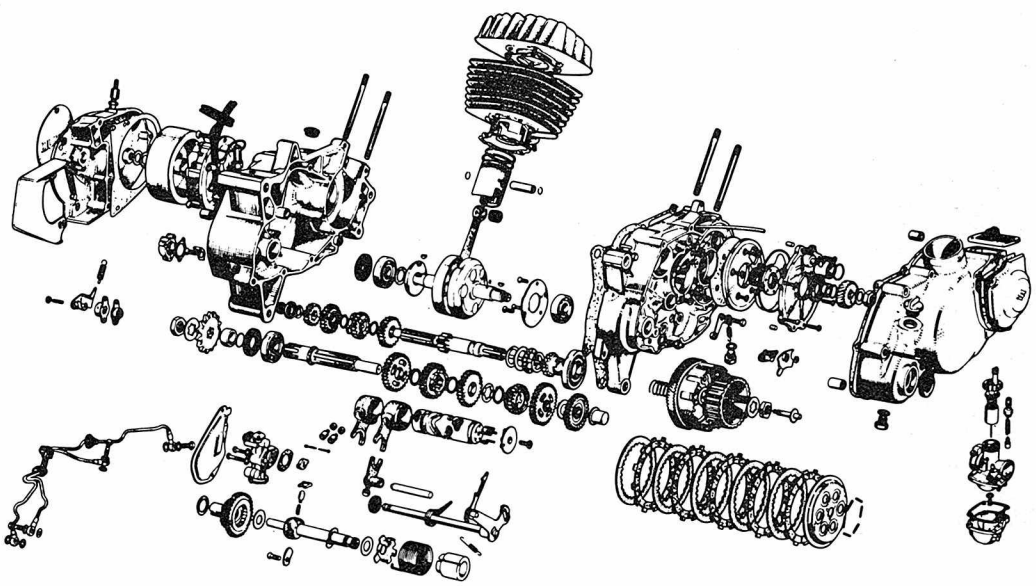


Fig. S8-15 — Exploded view of TS 90 engine/transmission assembly. TC 90 is similar, only gear box (Fig. S8-10) is used.

SUZUKI STEP THOUGH F 50 MODELS

MODEL	F 50 F 50 R
Displacement—cc	49
Bore—MM	41
Stroke—MM	37.8
Number of cylinders	1
Oil-Fuel ratio	Oil Injection
Plug gap—inch	0.020-0.024
Point gap—inch	0.012-0.016
Ignition timing	Fixed
Degrees BTDC	20
Electrical system voltage	6
Tire size—Front	2.25x17
Rear	2.25x17
Tire pressure—Front	23 PSI
Rear	31 PSI
Rear chain free play—inch	0.6-0.8
Number of speeds	3
Weight—Lbs. (approx.)	154

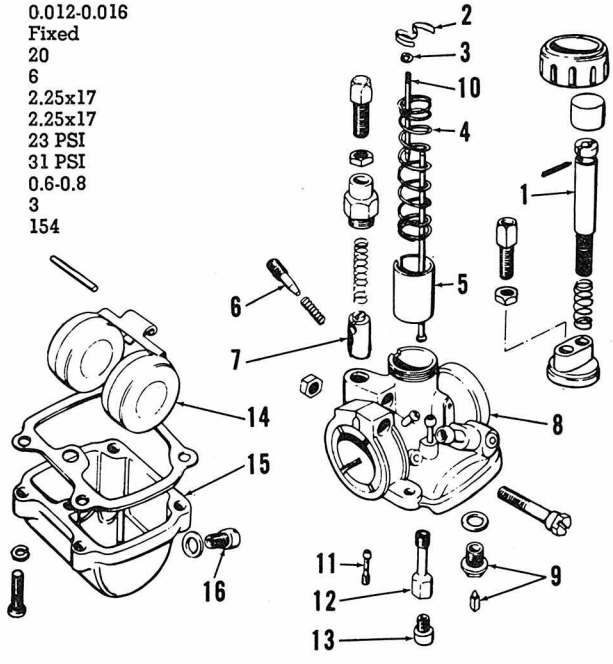


Fig. S9-1 — Exploded view of carburetor used on reed valve 50 cc Suzuki engines.

1. Idle adjusting screw
2. Spring clip
3. Jet needle clip
4. Throttle return spri
5. Throttle slide
6. Pilot air screw
7. Starter plunger
8. Throttle body
9. Fuel valve
10. Jet needle
11. Pilot jet
12. Needle jet
13. Main jet
14. Floats
15. Float chamber
16. Float chamber plug

MAINTENANCE

SPARK PLUG. Standard recommended spark plug is an NGK type BP-4H. A Champion type UL 15Y is a suitable replacement. Plugs should have a 0.020-0.024 inch electrode gap.

CARBURETOR. A Mikuni VM 14 SC carburetor is used. Float level, from bottom of float to gasket surface, should be 23 MM (0.906 in.) with carburetor inverted.

Refer to Fig. S9-1 and the following specifications for standard jet sizes:

Main jet (13) .....#102.5
Pilot jet (11) .....#17.5
Jet needle (10) .....3 F 3
Needle jet (12) E-0
Throttle valve (5) .....#2.5
Clip (3) in third groove from top of needle (10).

Initial setting of pilot air screw (6) is 1¼ turns out from a lightly seated position. Throttle cable should be adjusted to obtain 1/64-1/32 inch free play at top of carburetor.

Repair of reed valve is not recommended.

IGNITION AND ELECTRICAL. A six volt electrical system is used with a 6V 4AH battery. The flywheel alternator and magneto is mounted at left end of crankshaft. A selenium rectifier is mounted to convert AC current to DC current for battery charging.

Ignition point gap should be 0.012-0.016 inch. Ignition should occur (points just open) when piston is 1.56 MM (0.0614 in.) BTDC. Timing mark on flywheel should just align with pointer on left crankcase cover (See Fig. S9-2) at this time. Magneto base plate may be moved to adjust timing. Clockwise movement of base plate will advance ignition.

LUBRICATION. The gearbox contains 0.48 qt. of SAE 20W/40 motor oil. Transmission lubricant should be renewed every 3000 miles.

Engine lubrication is accomplished by an automatic oil metering system. Two cycle engine oil is pumped to the right crankcase cover and to the left main bearing.

Quantity of oil pumped is regulated by amount of throttle opening and engine RPM. Adjustment of oil pump may be checked by observing that alignment mark on oil pump is aligned with pointer (B—Fig. S9-3) when mark on throttle slide (A) is aligned with top of throttle bore in carburetor. Turn oil pump cable adjuster to obtain proper alignment.

If pump is removed or allowed to run dry, it will be necessary to bleed system. Pump and pump intake line are bled by loosening screw (C) and allowing oil to flow until air is longer present in oil coming from fitting. If air is present in pump output lines, remove screw (D or E) and use a

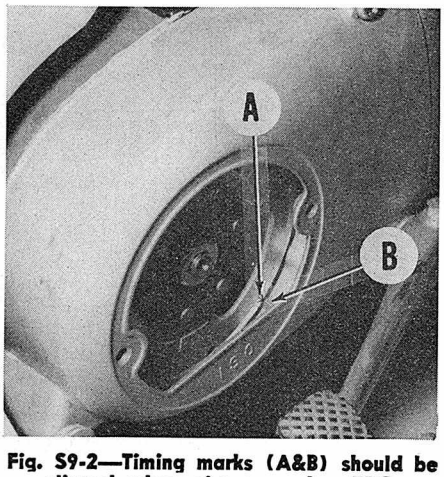


Fig. S9-2—Timing marks (A&B) should be aligned when piston reaches TDC.

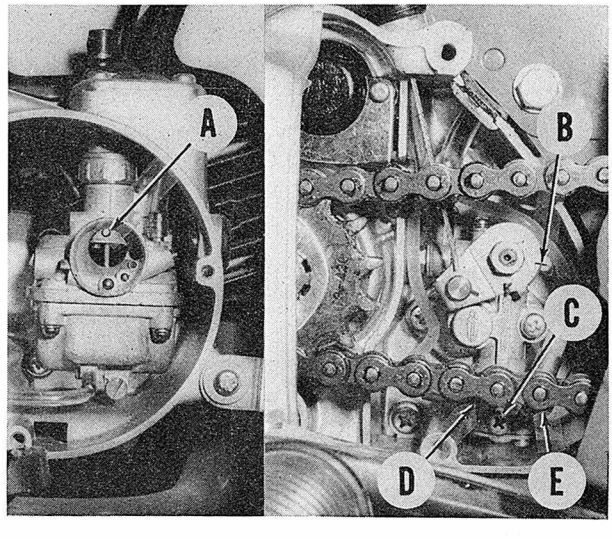


Fig. S9-3 — Oil pump should be adjusted so that marks on oil pump align when mark on throttle slide (A) is even with top of throttle bore.

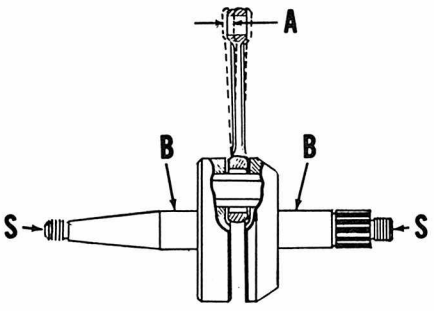


Fig. S9-4—Crankshaft should be supported in lathe centers at (S) to check eccentricity.

squirt type oil filler with two cycle oil in it to purge lines.

REPAIRS

PISTON, RINGS AND CYLINDER. Cylinder and piston may be removed without removing engine from frame. Refer to the following repair specifications:

Maximum cylinder taper or out of round .....0.002 inch
Piston skirt to cylinder clearance—
Standard .....0.0028-0.0031 inch
Limit .....0.00975 inch
Piston ring end gap—
Standard .....0.006-0.014 inch
Limit .....0.04 inch

Pistons should be installed with arrow on dome toward front (exhaust side) of engine. Install rings with markings on top side. Top piston ring is Keystone type (top of ring is tapered 7 degrees) and lower ring is not. Expander is installed behind bottom piston ring and top ring has no expander. Pistons and rings are available in standard and two oversizes. Torque head retaining nuts to 86 inch pounds using a cross pattern to prevent head warpage.

CONNECTING ROD AND CRANKSHAFT. Engine must be removed from frame and crankcases separated

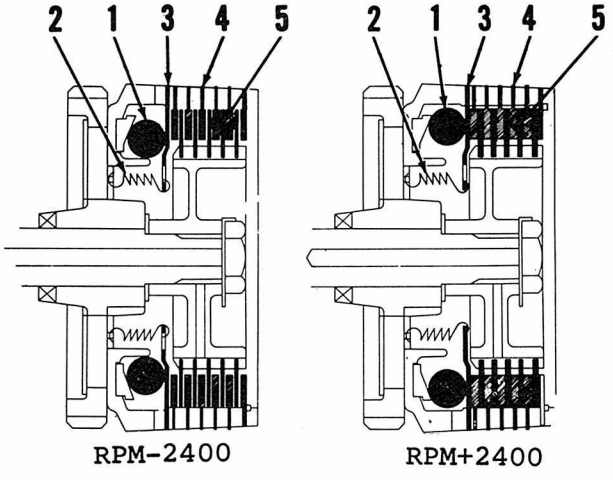


Fig. S9-5 — Cross sectional view of automatic clutch used on F 50 and F 50R models.

1. Steel ball
2. Clutch spring
3. Inner plate
4. Friction disc
5. Steel plate

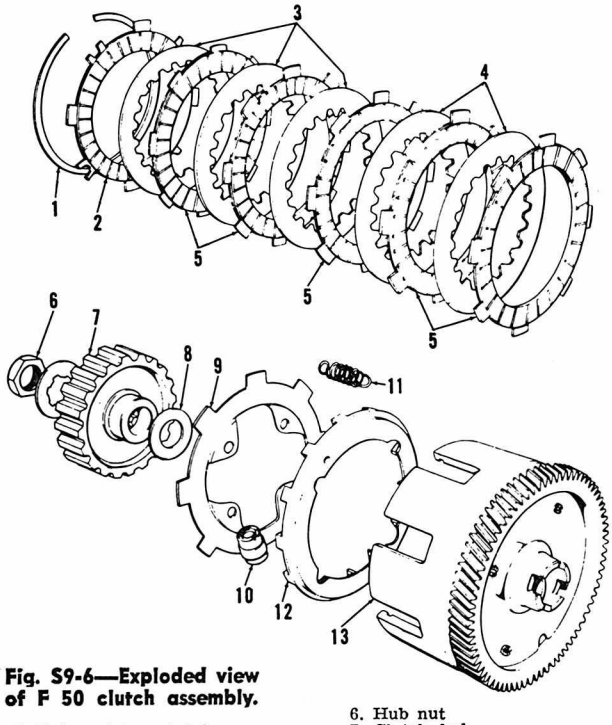


Fig. S9-6—Exploded view of F 50 clutch assembly.

1. Drive plate retaining clip
2. Outer drive plate
3. Driven plates (1.6 MM thick)
4. Driven plates (1.2 or 1.4 MM thick)
5. Friction discs
6. Hub nut
7. Clutch hub
8. Thrust washer
9. Inner clutch plate
10. Clutch roller
11. Clutch spring
12. Roller guide ring
13. Primary driven gear assembly

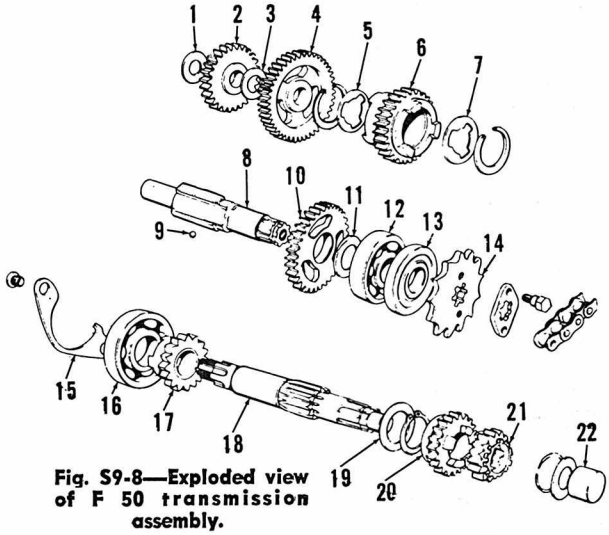


Fig. S9-8—Exploded view of F 50 transmission assembly.

1. Thrust washer
2. Kick idle gear
3. Thrust washer
4. First driven gear
5. Ball washer
6. Third driven gear
7. Ball washer
8. Drive shaft
9. Ball
10. Second driven gear
11. Thrust washer
12. Ball bearing
13. Oil seal
14. Drive sprocket
15. Bearing retainer
16. Ball bearing
17. Kick driven gear
18. Counter shaft
19. Thrust washer
20. Third drive gear
21. Second drive gear
22. Shaft bushing

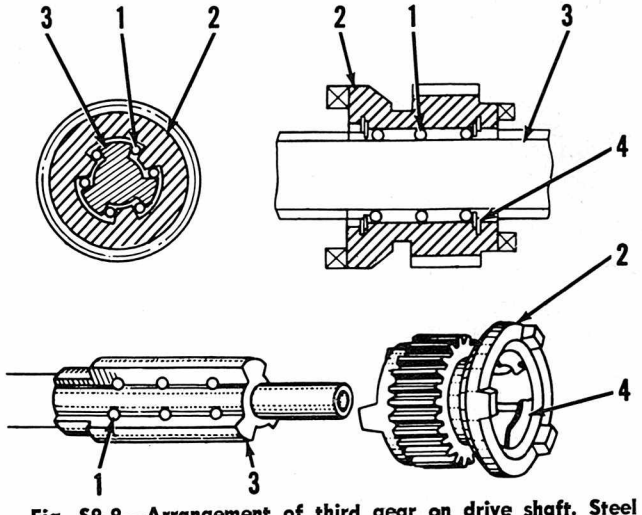


Fig. S9-9—Arrangement of third gear on drive shaft. Steel balls are held in position by holding washer (4).

1. Steel balls
2. Third gear
3. Drive shaft
4. Holding washer

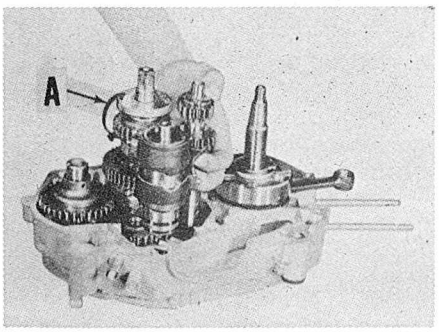


Fig. S9-10—A special gear holding tool (A) is available to aid in transmission installation.

to remove crankshaft. Maximum allowable eccentricity of crankshaft when supported on "V" blocks is 0.00394 inch. Standard tolerance is 0.00236 inch or less. Shake at small end of connecting rod should be less than 0.118 inch. Nut that secures primary pinion gear to right end of crankshaft should be torqued to 32 Ft.-Lbs.

CLUTCH. F 50 models are equipped with a wet, multi disc, automatic clutch. Clutch is engaged by centrifugal force at approximately 2400 RPM. Springs (2—Fig. S9-5) hold clutch inner plate (3) in a released position. At approximately 2400 RPM, rollers (1) move outward and engage clutch plates (4&5).

If clutch does not engage at proper RPM check:

Clearance between inner plate (9—Fig. S9-6) and inner cork friction disc (5). Proper clearance is 0.055-0.071 inch. Adjust clearance by varying the thickness of steel plates (4). Plates are available in thicknesses of 1.2 MM (0.047 in.), 1.4 MM (0.055 in.) and 1.6 MM (0.063 in.). If necessary, two steel plates may be stacked together to achieve proper clearance.

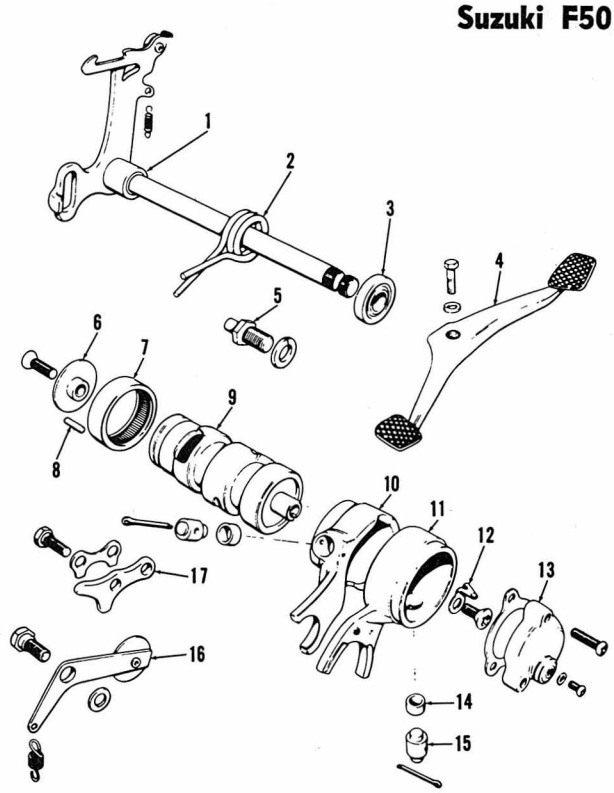


Fig. S9-12 — Component parts of shifter assembly.

1. Shifting shaft assembly
2. Shift return spring
3. Oil seal
4. Shift lever
5. Shift arm stopper
6. Cam pin retainer
7. Cam bearing
8. Shift cam roller
9. Shift cam
10. High speed shift fork
11. Low speed shift fork
12. Neutral switch
13. Neutral switch cover
14. Shifting guide spacer
15. Fork pin
16. Shifting cam stopper
17. Shift cam guide

Free lengh of clutch springs (11). Standard free length is 15.5 MM (0.610 in.). Renew springs if longer than 16.0 MM (0.629 in.).

Thickness of friction discs (5). Standard thickness is 3.0 MM (0.118 in.). Renew discs if less than 2.85 MM (0.112 in.) thick.

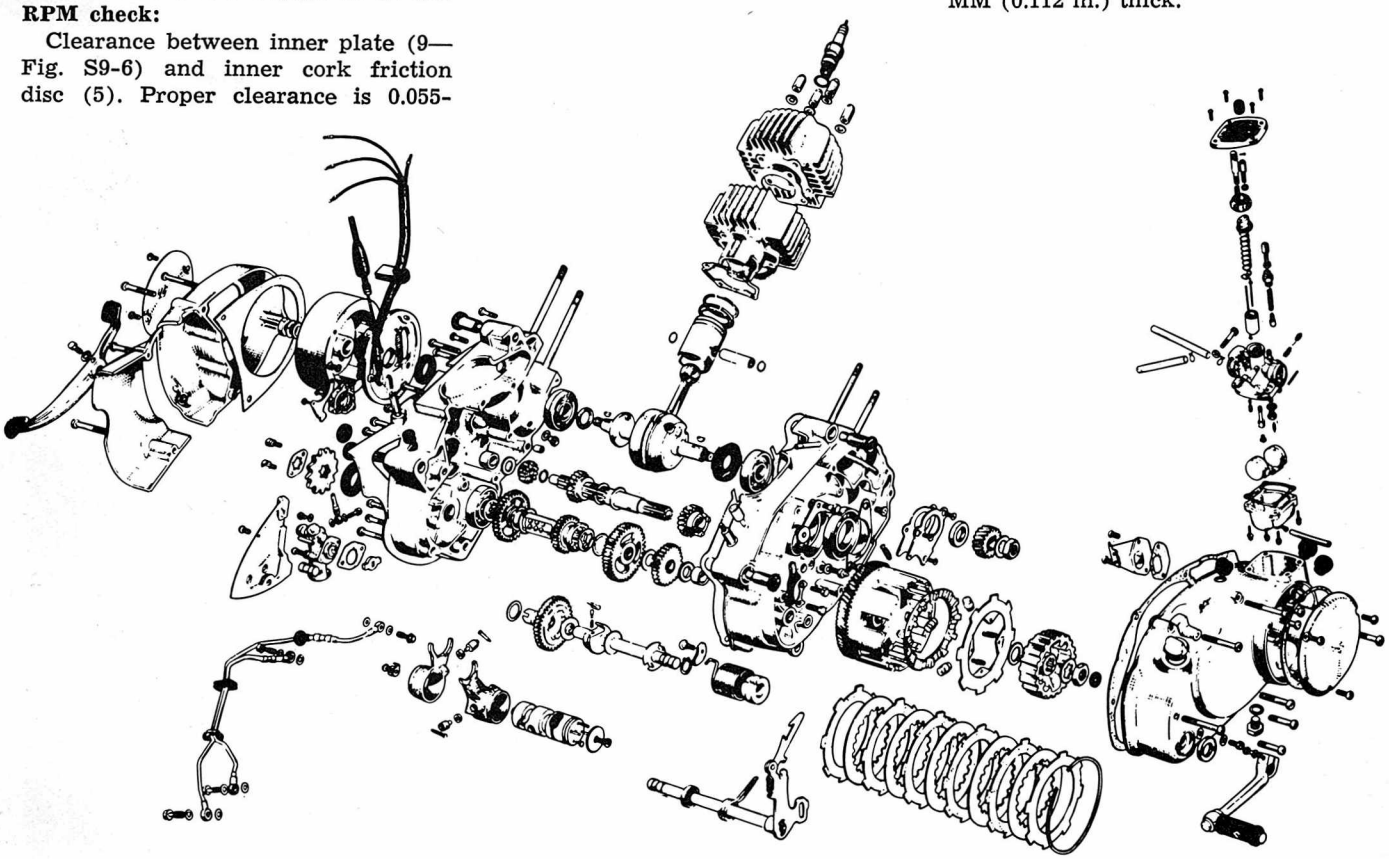


Fig. S9-13—Exploded view of engine assembly used in F 50 and F 50 R models.

Arrangement of clutch rollers (10). Rollers must be installed in grooves of clutch housing primary gear assembly (13).

TRANSMISSION. The three speed constant mesh transmission may be removed after separating the crankcase halves.

Clearance between shift fork and groove of sliding gears should be 0.008-0.016 inch. If clearance is more than 0.032 inch, renew gear and/or fork.

Transmission should be assembled in right crankcase half. Place right case flat on work surface and lay thrust washer (1—Fig. S9-8) in proper position followed by the kick starter idle gear (2), flat side down, and the second thrust washer (3). Assemble third gear on drive shaft with 18 steel balls. A special tool is available from Suzuki to secure the gear in position for assembly. Transmission and gear shift drum assembly should then be placed in the right case as a unit (See Fig. S9-10).

SUZUKI 50CC ROTARY VALVE MODELS

MODEL	AS50	AC50	TS50
Displacement—cc	49	49	49
Bore—MM	41	41	41
Stroke—MM	37.8	37.8	37.8
Number of cylinders	1	1	1
Oil-Fuel ratio	Oil Injection		
Plug gap—inch	0.019		
Point gap—inch	0.012-0.016		
Ignition timing	Fixed		
Degrees BTDC	24		
Electrical system voltage	6	6	6
Tire size—Front	2.25x17	2.25x17	2.25x17
Rear	2.25x17	2.50x17	2.50x17
Tire pressure—Front	23 PSI	23 PSI	23 PSI
Rear	29 PSI	29 PSI	29 PSI
Rear chain free play—inch	0.06-0.08	0.06-0.08	0.06-0.08
Number of speeds	5	5	5
Weight—Lbs. (approx.)	158	158	156

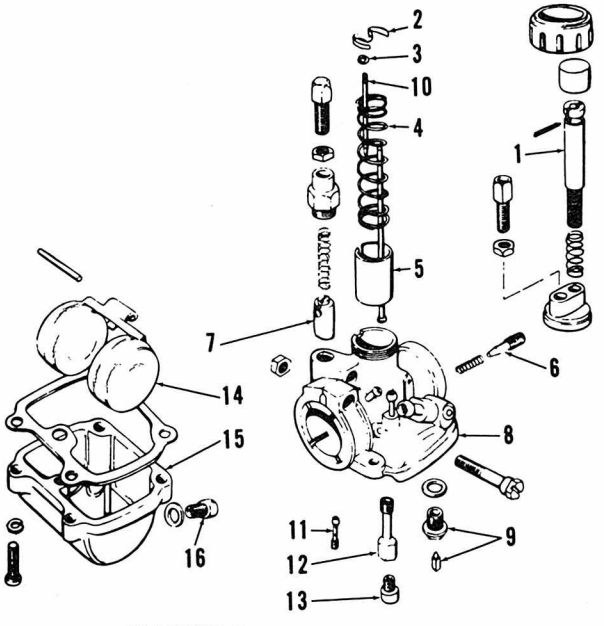


Fig. S10-1 — Exploded view of carburetor used on all models.

1. Idle speed adjusting screw
2. Spring clip
3. Jet needle clip
4. Throttle return spring
5. Throttle slide
6. Pilot air screw
7. Starter plunger
8. Throttle body
9. Fuel valve
10. Jet needle
11. Pilot jet
12. Needle jet
13. Main jet
14. Floats
15. Float chamber
16. Float chamber drain plug

MAINTENANCE

SPARK PLUG. Standard recommended spark plug is an NGK type B-77HC with an electrode gap of 0.019 inch. A Champion type L 62R or other equivalent plug may be used as a replacement.

CARBURETOR. A Mikuni VM 16 SC sliding valve carburetor is used on all models.

Initial setting of pilot air screw (6—Fig. S10-1) should be 1½ turns out on AC 50 and TS 50 models and 2 turns out on AS 50 models. Float level should be 22.5 MM (0.885 in.) on all models and is adjusted by bending tang (B—Fig. S10-2). Refer to Fig. S10-1 and the following specifications for standard sizes:

AS 50 Models

Main jet (13) ..... #70
Needle jet (12) E-2
Jet Needle (10) .....3 G 1
Clip (3) in second groove from top of needle (10).

AC 50 Models

Main jet (13) ..... #70
Needle jet (12) E-2
Jet Needle (10) .....3 E 3
Clip (3) in third groove from top of needle (10).

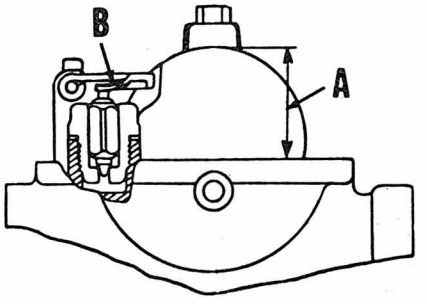


Fig. S10-2—Float level (A) may be adjusted by bending tang (B).

TS 50 Models

Main jet (13) .....#75
Needle jet (12) E-2
Jet needle (10) ..... 3 E 3
Clip (3) in third groove from top of needle (10).

Throttle cable should be adjusted to obtain 0.02-0.04 inch free play in cable at top of carburetor.

IGNITION AND ELECTRICAL. A 6V 4AH battery is used to provide power for neutral indicator light, stop light and horn with engine stopped. An alternator is built into the flywheel magneto and provides AC power for head light, tail light, high beam indicator light and speedometer housing light. The rectifier, mounted beneath seat, converts AC current to DC current for battery charging, horn, neutral light and stop light when engine is running.

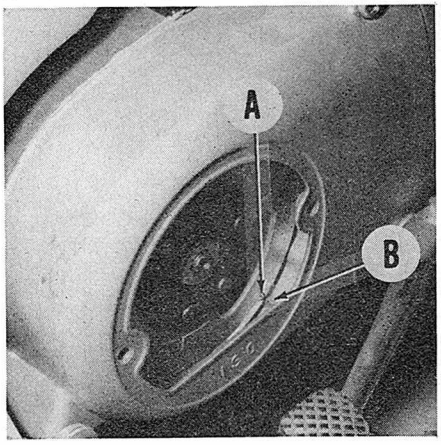


Fig. S10-3—Ignition points should just open as timing marks (A&B) align.

The energy transfer ignition system uses a low tension coil under the flywheel and a high tension coil mounted on the frame.

Gap of ignition points should be set at 0.014 inch. Ignition should occur (points just open) when piston is 2.01 MM (0.079 in.) BTDC. Timing mark on flywheel (A—Fig. S10-3) will align with pointer (B) in left engine cover at this time. Timing may be adjusted by moving magneto base plate after removing flywheel.

LUBRICATION. Gearboxes on all models are lubricated with SAE 20W/40 motor oil. Capacity of TS 50 gearbox is 700cc (0.72 qt.); AS and AC 50 gearbox capacity is 550cc (0.58 qt.). Transmission lubricant should be drained and renewed every 3000 miles.

Engine lubrication is accomplished by an automatic oil metering system. Two cycle engine oil is pumped to the crankshaft left main bearing and to the rotary valve cover.

If oil pump has been removed or allowed to run dry, system must be bled of all air in lines to prevent possible seizure. Oil pump and oil pump inlet line may be bled by loosening screw (C—Fig. S10-4) and allowing oil to flow until air is no longer present in oil coming from bleeder hole. Oil pressure lines must be purged by removing screws (D&E) in pressure line banjo bolts and squirting two cycle engine oil into fittings until air is removed.

Oil pump adjustment on AS and AC 50 models is correct if aligning marks (B) meet when throttle is wide open. On TS 50 models, marks (B) should align as mark on throttle slide meets top of throttle bore (A).

CLUTCH CONTROLS. Clutch may be adjusted after removing clutch adjustment cover of left engine case cover. Loosen lock nut (A — Fig. S10-5) and turn adjusting screw (B) until screw just contacts push rod (slight resistance will be felt). Back screw (B) out ½ turn and tighten lock nut (A). Adjust clutch control cable to obtain ⅛ inch free play in clutch lever at pivot at control handle.

SUSPENSION. Front suspension units on all models contain 125cc of oil each. Front forks may be disassembled by clamping fork outer tube nut (11—Fig. S10-7) in a vise and turning the outer tube (15). See Fig. S10-8.

Rear suspension units are not repairable and should be renewed if leaking or damaged.

REPAIRS

PISTON, RINGS AND CYLINDER. Cylinder and piston may be removed without dismounting engine from frame. Refer to the following repair specifications:

Piston skirt to cylinder clearance ..... 0.0026-0.0027 inch
Maximum cylinder taper or out of round ..... 0.002 inch
Maximum cylinder head warpage ..... 0.0012 inch
Piston ring end gap . 0.004-0.0118 inch

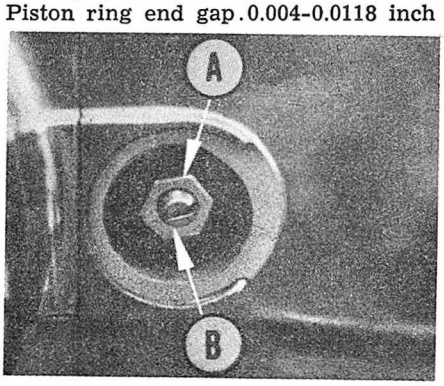


Fig. S10-5—After removing rubber plug on left engine cover, loosen lock nut (A) and turn screw (B) to adjust clutch.

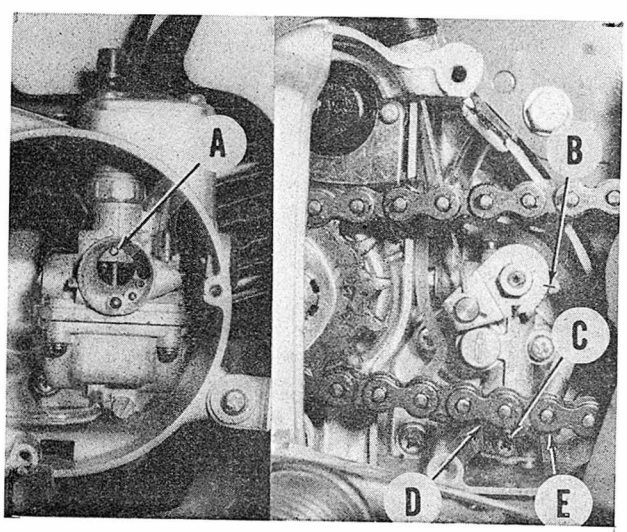


Fig. S10-4—Oil pump on TS 50 models should be adjusted so that aligning marks on pump pulley (B) meet when mark on throttle slide is aligned with top of throttle bore (A). Other models require that throttle be wide open before pump timing marks align.

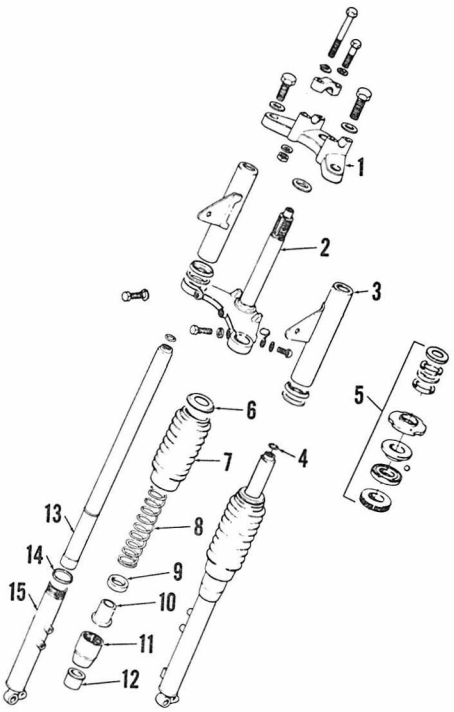


Fig. S10-7—Exploded view of front suspension system used on AC 50 models. Others are similar.

1. Steering stem head
2. Steering stem
3. Inner tube cover
4. "O" ring
5. Front suspension bearing
6. Spring guide
7. Rubber boot
8. Fork spring
9. Oil seal
10. Steel slider
11. Outer tube nut
12. Tube guide
13. Inner fork tube
14. "O" ring
15. Outer fork tube

Piston is installed with arrow on dome toward front (exhaust side) of engine. Piston rings are installed with markings on top side. Retaining clips that secure piston pin in piston should be renewed after each usage. Measure piston ⅛ inch from bottom at a right angle to pin hole for cylinder clearance check. Pistons are available in standard and two oversizes. Head retaining nuts should be torqued to 180-230 inch-pounds using a cross pattern to prevent head warpage.

CRANKSHAFT AND CONNECTING ROD. Engine must be removed from frame and crankcase halves separated to remove the crankshaft.

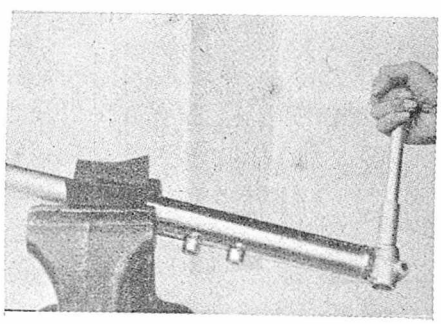


Fig. S10-8—Take precautions to prevent damage to fork outer tube nut when clamped in vise. A portion of a discarded tire tube may be used.

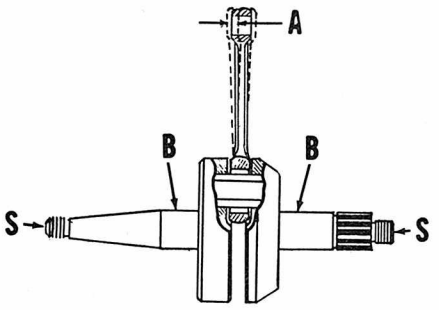


Fig. S10-9—Support crankshaft in lathe centers at (S) and measure runout at (B).

Maximum crankshaft eccentricity at bearing surface (B—Fig. S10-9) should be 0.002 inch or less with the crankshaft supported at (S). Renew connecting rod, crankpin, thrust washers and/or lower end rod bearing if shake at small end of rod (A) exceeds 0.12 inch.

CRANKCASE AND GEARBOX. The five speed constant mesh transmission may be removed after separating the crankcase halves. All ball bearings in crankcases are shrink fitted in case and heat must be used to remove or install any bearing. Transmission and shifter components should be assembled in right crankcase half for ease of assembly. Crankcase mating surfaces must be thoroughly cleaned and coated with a non-hardening type sealer. Rotary valve must be installed with punch mark out and aligned with dowel in crankshaft.

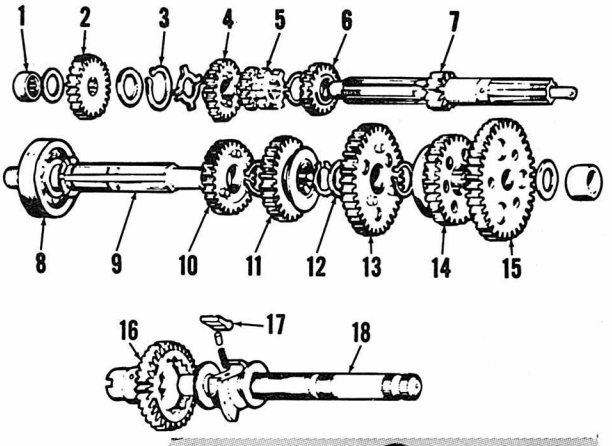


Fig. S10-10 — Exploded view of transmission typical of all models.

1. Needle bearing
2. Fifth gear
3. Fourth drive gear snap ring
4. Fourth gear
5. Second gear
6. Third gear
7. Counter shaft
8. Ball bearing
9. Drive shaft
10. Fifth driven gear
11. Fourth driven gear
12. Thrust washer
13. Second driven gear
14. Third driven gear
15. First driven gear
16. Kick drive gear
17. Starter pawl
18. Kick starter shaft

CLUTCH A wet multi disc clutch is used on all models. Standard free length of clutch springs (13—Fig. S10-14) is 1.295 inch and springs should

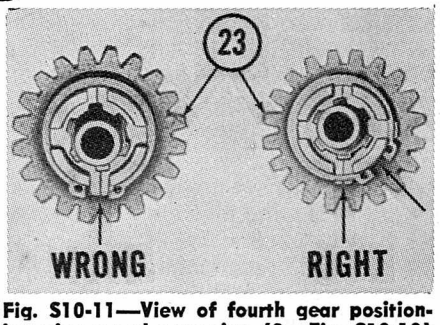


Fig. S10-11—View of fourth gear positioning pieces and snap ring (3—Fig. S10-10) assembled. Split in positioning pieces and opening in snap ring should not be aligned.

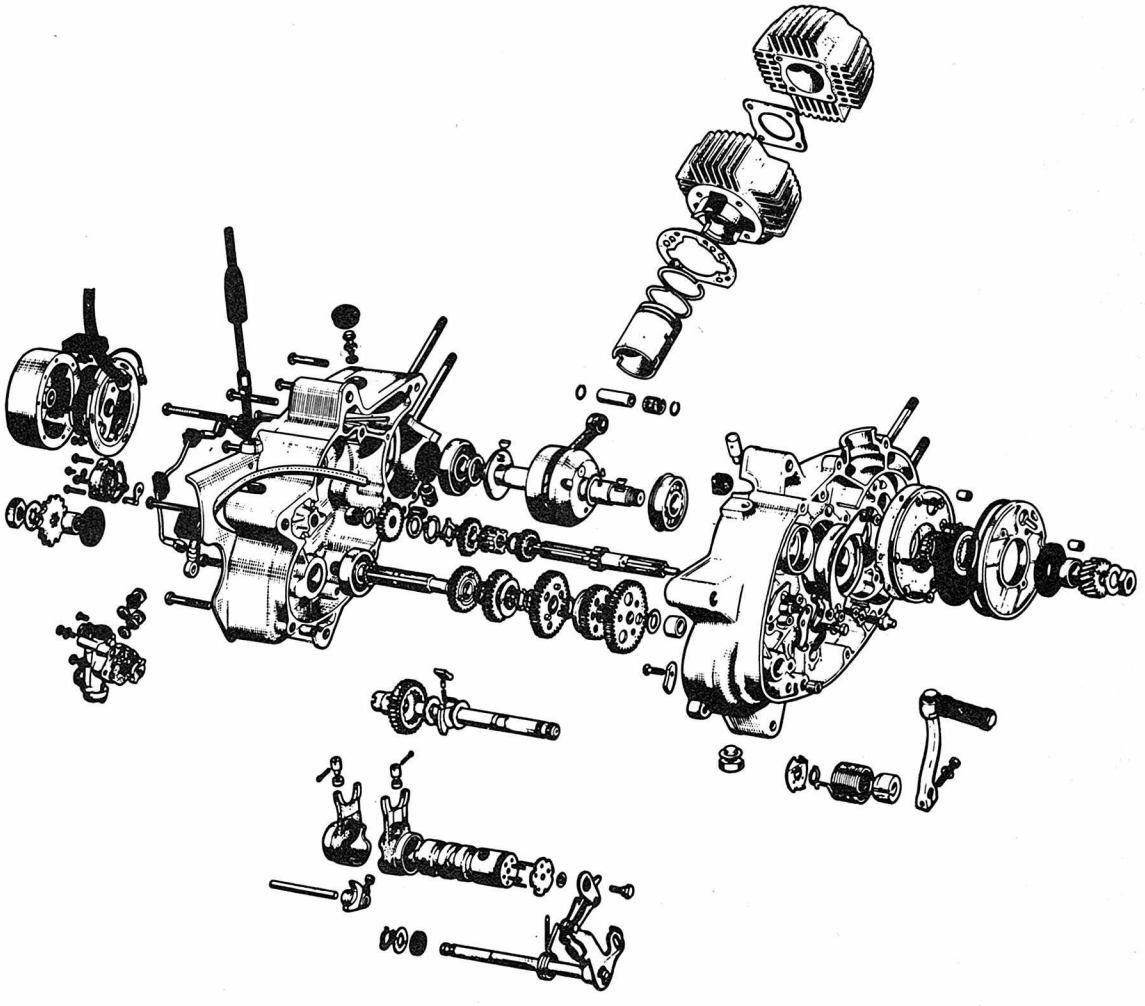


Fig. S10-12—Exploded view of engine assembly typical of rotary valve 50cc models.

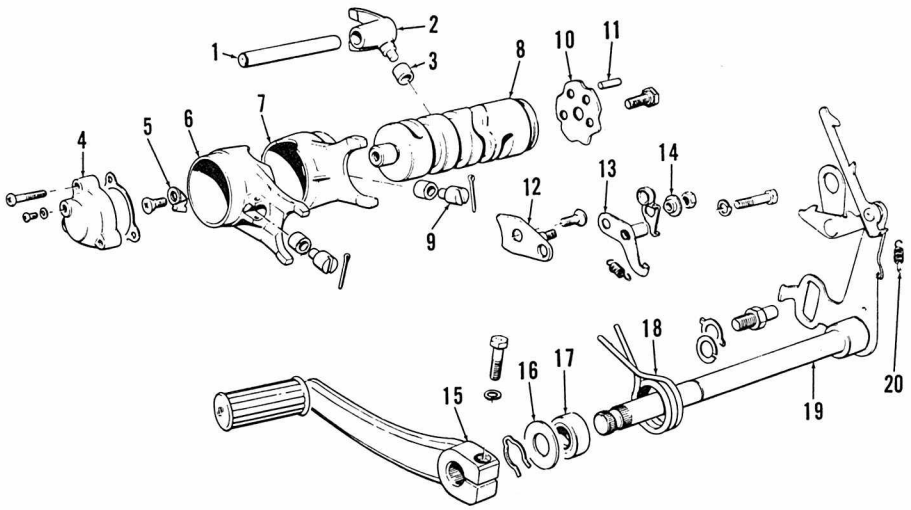


Fig. S10-13—Shifter assembly used on AC 50 model. Other units are similar.

1. Shift fork shaft
2. High gear shifting fork
3. Guide roller
4. Neutral switch cover
5. Neutral switch
6. Shifting fork
7. Shifting fork
8. Shift cam drum
9. Shift fork guide
10. Stopper plate
11. Cam pin
12. Shift cam guide
13. Spring holder
14. Shift cam stopper spacer
15. Shift lever
16. Thrust washer
17. Oil seal
18. Shift return spring
19. Shifter shaft assembly
20. Shift pawl return spring

be renewed if more than 1.343 inches long. Standard thickness of friction disc (2) is 0.114-0.122 inch and discs should be renewed if less than 0.110 inch thick.

Install clutch springs (13) in hub (12) so that flat end of spring does not protrude from lower side of hub. Align punch marks on hub and pressure plate (4) when assembling.

SPEED TUNING

An MX kit is available from US Suzuki to improve performance in the 50cc AS 50, AC 50 and TS 50 models. The following paragraphs describe the variations between standard and MX Kit parts. Any modification of standard parts or installation of performance parts will void the manufacturers warranty.

SPARK PLUG AND IGNITION. The modified engine requires a one or two stage cooler spark plug (NGK type B-8EN or B-9EN). The kit cylinder head requires a ¾ inch reach spark plug.

Lighting coils should be removed from the standard magneto. Attach black wire from primary coil to black wire on ignition coil to bypass ignition switch.

CARBURETOR. The MX Kit is equipped with a 22 MM carburetor with the following specifications:

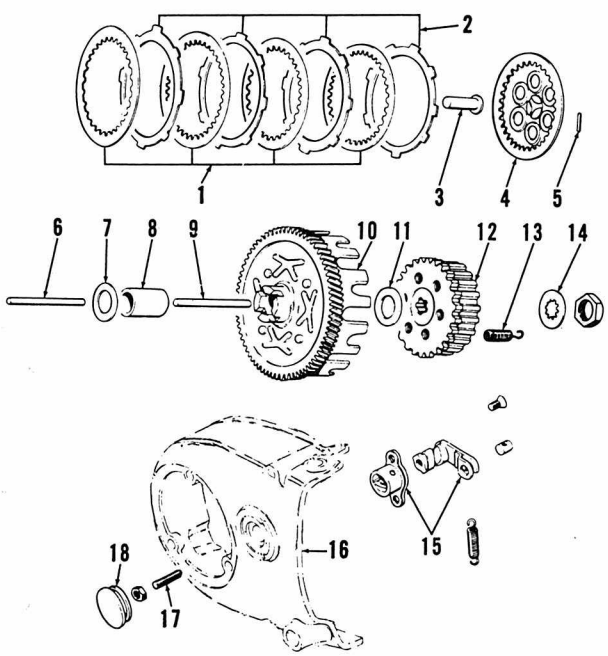


Fig. S10-14 — Exploded view of clutch unit common to all models.

1. Steel plates
2. Friction discs
3. Release rod
4. Pressure plate
5. Spring pin
6. Push rod
7. Thrust washer
8. Spacer
9. Push rod
10. Primary driven gear assembly
11. Thrust washer
12. Clutch hub
13. Clutch spring
14. Washer
15. Release screw assembly
16. Left engine case cover
17. Clutch adjusting screw
18. Rubber clutch adjustment cover

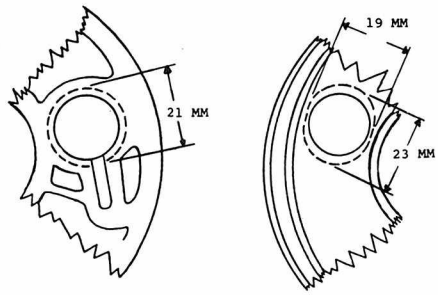


Fig. ST10-1—Rotary Valve cover should be modified by enlarging intake passage to 21 MM on the outside and tapering the hole to a 19x23 MM hole on the inside of the cover. Modify intake on crankcase to match rotary valve cover.

Main jet	#130-140
Pilot jet	17.5
Needle jet	0-0
Jet needle	4 DG 6
Throttle valve	2.0

Jet needle clip in fourth groove from top of needle.

LUBRICATION. Disconnect oil pump cable and use a 20:1 fuel to oil mixture in the fuel tank. Oil pump will run at idle and supply necessary lubrication for main bearings. Same type oil should be used in fuel that is used in oil tank.

SUSPENSION. Use 130cc of SAE 30 or heavier motor oil in each fork tube.

PISTON, CYLINDER AND HEAD. The cylinder head used in the MX Kit provides a compression ratio of 7.5:1 compared to a 6.7:1 standard compression ratio.

Piston uses two Keystone type rings and should have a cylinder clearance of 0.0026-0.003 inch.

The exhaust port of the MX Kit opens and closes 88.5 degrees before and after Bottom Dead Center. The transfer ports in the MX Kit cylinder open and close 63 degrees before and after Bottom Dead Center.

CRANKCASE, ROTARY VALVE AND ROTARY VALVE COVER. The standard rotary valve is used in the MX Kit.

Use a scribe or other sharp pointed instrument to mark a 21 MM circle on the outside of the rotary valve cover, using the right hand engine cover as a guide. Remove the rotary valve cover and scribe a 19x23 MM oval on the inside of the cover. See Fig. ST 10-1. Use a high speed grinder or a rat tail file to enlarge port in cover to these dimensions.

Enlarge the intake port in crankcase to mate with newly formed rotary valve cover.

The MX Kit is equipped with an expansion chamber.

SUZUKI 125CC TWIN CYLINDER MODELS

MODEL	T 125 T 125 II T 125 R
Displacement—cc	124
Bore—MM	43
Stroke—MM	43
Number of cylinders	2
Oil-Fuel Ratio	Oil Injection
Plug gap—inch	0.027
Point gap—inch	0.012-0.016
Ignition timing	Fixed
Degrees BTDC	24
Electrical system voltage	6
Tire size—Front	2.50x18
Rear	2.75x18
Tire pressure—Front	22 PSI
Rear	30 PSI
Rear chain free play—inch	0.06-0.08
Number of speeds	5
Weight—Lbs. (approx.)	226.7

MAINTENANCE

SPARK PLUG. Standard recommended spark plug is the NGK type BP-7H with a 0.027 inch electrode gap. A Champion type L85 is a suitable replacement plug.

CARBURETORS. Two Mikuni MD-18 carburetors are used. Throttle cables should be adjusted to obtain 1/64-1/32 inch free play at top of carburetor. Initial setting of pilot air screw (11—Fig. S11-1) should be 1½ turns out from a lightly seated position. Carburetors may be adjusted by removing one spark plug lead and adjusting throttle stop screw (1) on carburetor of other cylinder until lowest possible steady RPM is reached. Adjust pilot air screw (11) on same carburetor until smoothest RPM is attained. Adjust other carburetor in same manner and then run engine with both spark plugs connected. Readjust throttle stop screws (1) equal amounts until engine idles evenly at approximately 1500 RPM. The following specifications are standard:

Main jet (15) .....#72.5
Pilot jet (14) .....#20
Jet needle (7) .....4 F 13
Throttle slide (8) .....#2.5
Clip (5) in fourth groove from top of needle (7).

Float level should be 19 MM (¾ inch) and is measured from bottom of float to gasket surface of carburetor body with unit tilted only far enough for float to contact valve needle (do not compress spring).

IGNITION AND ELECTRICAL. A 6V 7.5 AH battery is frame mounted beneath the seat. A full wave rectifier is used to convert alternating current to DC for all electrical operations.

Two manufacturers were used to supply alternators for the T 125 series. Parts of the Nippon Denso and Kokusan Denki alternators do not interchange and it should be noted which unit is installed.

Ignition points should be set so that maximum point gap is 0.014 inch. Ignition should occur (points just open) when piston is 2.28 MM (0.089 inch) BTDC. Adjust each set of points separately. One of the two timing marks (B—Fig. S11-2) will align with mark (A) when each piston is in correct position for ignition.

LUBRICATION. The gearbox is lubricated by 800cc (1.8 qt.) of 20W/40 motor oil. Transmission lubricant should be drained and renewed at 3000 mile intervals.

An automatic oil metering system is used to supply lubrication for engine operation. Two cycle engine oil, stored in a separate tank, is pumped and metered by the oil pump. The oil pump is mounted on the right rear of engine case and is driven by the kick starter pinion.

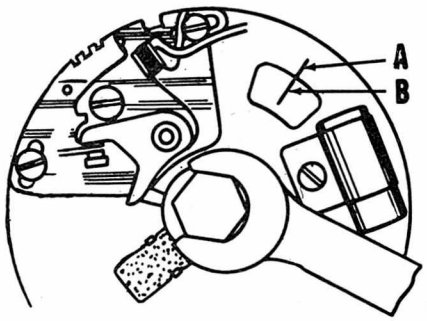


Fig. S11-2—Timing marks (A&B) will align when one piston is in position for ignition.

Oil pump adjustment may be checked after removing inspection cover on right rear of engine. Hold hand throttle full on and observe that marks (A&B—Fig. S11-3) are aligned. If adjustment is incorrect, turn cable adjuster (C) until marks align with throttle wide open.

If oil pump has been removed or allowed to run dry it will be necessary to bleed the system. Loosen the bleeder screw (D) and allow oil to flow into pump. Run engine at idle speed and hold pump control arm to the full open position to bleed pressure lines. If air persists in pressure lines check for leaks in fitting bolts.

CLUTCH CONTROLS. Clutch may be adjusted after removing adjustment cover from left side case. Loosen lock nut (10—Fig. S11-7) and turn adjusting screw (9) in until it touches

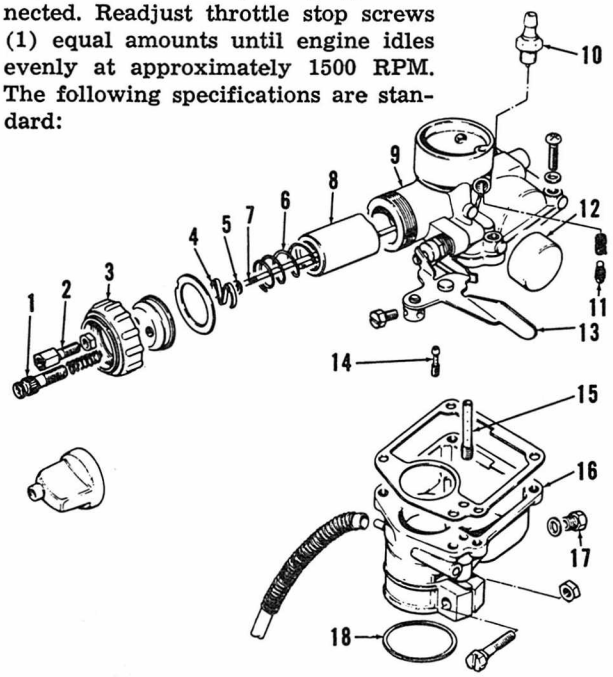


Fig. S11-1 — Exploded view of downdraft carburetor used on 125cc Suzuki twins.

1. Idle speed adjusting screw
2. Throttle cable adjuster
3. Mixing chamber cap
4. Spring retaining clip
5. Jet needle clip
6. Throttle return spring
7. Jet needle
8. Throttle slide
9. Throttle body
10. Fuel inlet valve needle assembly
11. Pilot air screw
12. Float
13. Starter lever
14. Pilot jet
15. Main jet
16. Float chamber
17. Float chamber drain plug
18. "O" ring

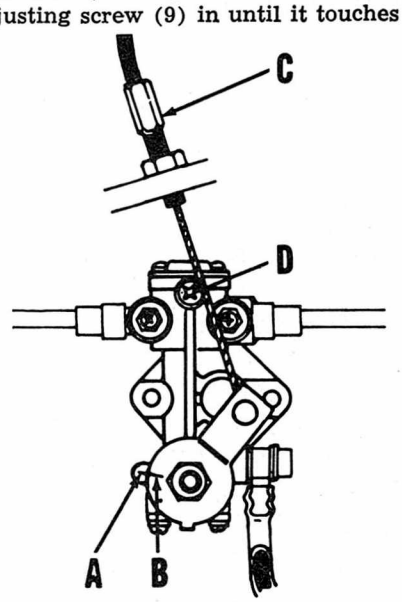


Fig. S11-3—With throttle wide open, marks (A&B) will align on correctly adjusted oil pump. Loosen bleeder screw (D) to remove air from system.

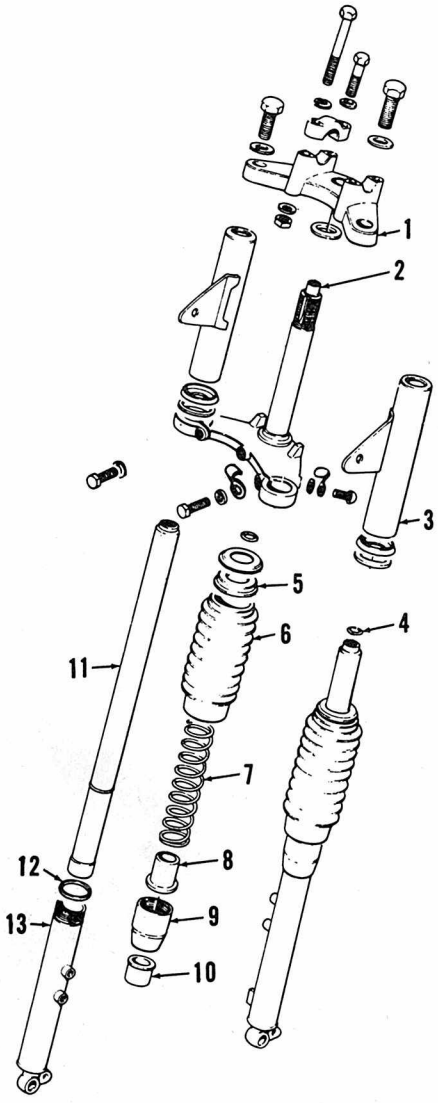


Fig. S11-5—Front suspension system used on T 125 II and T 125 R models. Other units are similar.

1. Top fork clamp
2. Steering stem
3. Inner tube cover
4. "O" ring
5. Spring seat
6. Spring cover
7. Fork spring
8. Dust seal
9. Outer tube nut
10. Inner tube guide
11. Inner fork tube
12. "O" ring
13. Outer fork tube

the push rod. Back adjusting screw (9) out ¼ turn and tighten lock nut. Turn adjuster on control cable to obtain ⅛ inch free play in pivot of control lever on hand grip.

SUSPENSION. Front suspension units on all models should be serviced with 130cc of SAE 30 motor oil. Forks may be disassembled by clamping the outer tube nut (9—Fig. S11-5) in a vise and turning outer tube (13).

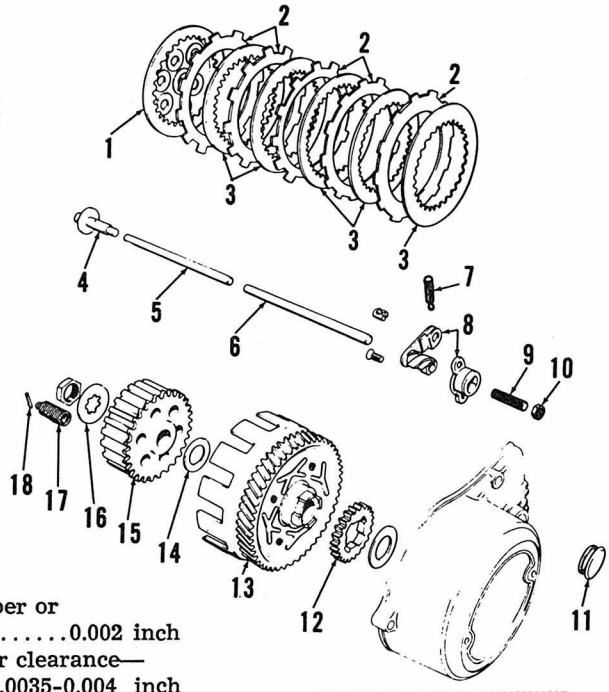
Rear suspension units are not repairable and should be renewed if leaking or damaged.

REPAIRS

PISTONS, RINGS AND CYLINDERS. Cylinders and pistons may be removed without removing engine from frame. Refer to the following repair specifications:

Fig. S11-7 — Clutch assembly common to all models.

1. Pressure plate
2. Friction discs
3. Steel plates
4. Clutch release rod
5. Push rod
6. Push rod
7. Release arm return spring
8. Release arm assembly
9. Clutch adjusting screw
10. Lock nut
11. Rubber plug
12. Kick gear
13. Primary gear assembly
14. Thrust washer
15. Clutch hub
16. Washer
17. Clutch spring
18. Spring pin



Maximum cylinder taper or out of round .....0.002 inch
Piston skirt to cylinder clearance—
Standard .....0.0035-0.004 inch
Limit .....0.0097 inch
Piston ring end gap—
Standard .....0.0117 inch
Limit .....0.046 inch
Top piston ring side clearance—
Standard .....0.0010-0.0035 inch
Limit .....0.010 inch
Bottom piston ring side clearance—
Standard .....0.00078-0.0021 inch
Limit .....0.0058 inch

Pistons must be installed with arrow on dome toward front (exhaust side of engine. Top piston ring is Keystone type and must be installed with 7 degree taper toward top. Markings on all rings go toward top. Pistons and rings are available in standard and two oversizes. Measure piston ¾ inch from bottom at a right angle to pin hole for cylinder clearance check. Torque cylinder head retaining nuts to 8 Ft.-Lbs. using a cross pattern to prevent head warpage.

CLUTCH. Clutch may be serviced without removing engine from frame. Standard thickness of friction discs (2—Fig. S11-7) is 0.118 inch (3 MM). Discs should be renewed if less than 0.110 inch (2.8 MM). Standard free length of spring (17) is 1.25 inch. Springs should be renewed if more than 1.30 inch long.

Clutch springs should not protrude through bottom of clutch hub (15) on reassembly. Kick starter gear (12) and primary gear assembly (13) have lubrication grooves machined in them that must be aligned on reassembly. Make certain that aligning marks on pressure plate (1) and clutch hub (15) are aligned on reassembly. (Fig. S11-8)

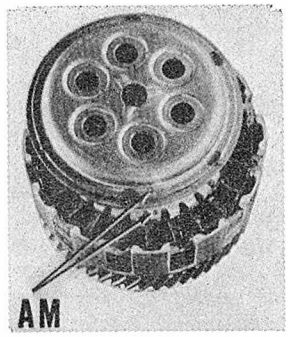


Fig. S11-8—Punch marks on clutch hub and pressure plate should be aligned when reassembling clutch.

CRANKSHAFT AND CONNECTING RODS. Engine must be removed from frame and crankcase halves separated to remove the crankshaft assembly. With crankshaft supported on "V" blocks, maximum eccentricity should be 0.004 inch at ends of shaft. Maximum shake at small end of connecting rod is 0.156 inch. Renew connecting rod, crankpin, side washers and/or large end needle bearing if small end shake is excessive. Crankshaft should only be disassembled if proper tools are available to correctly reassemble and align unit.

When reinstalling crankshaft make certain that all dowels and retaining clips are correctly installed and that recesses in crankshaft main bearings are properly aligned with dowels. Punch marks are located 180 degrees from recesses in bearings to aid installation. Crankshaft oil seals should be checked for proper positioning after crankshaft is installed in crankcase half. Two Suzuki special tools are available to align seals.

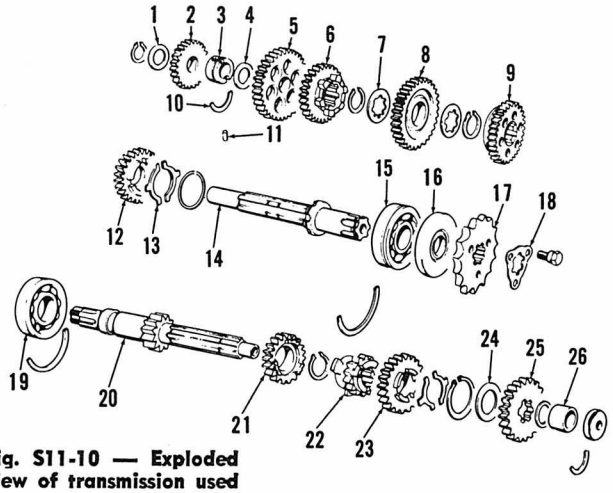


Fig. S11-10 — Exploded view of transmission used in all models.

1. Thrust washer
2. Kick starter idle gear
3. Bushing
4. Thrust washer
5. First driven gear
6. Third driven gear
7. Washer
8. Second driven gear
9. Fourth driven gear
10. Bushing retaining clip
11. Bushing pin
12. Fifth driven gear
13. Retaining clips
14. Drive shaft
15. Ball bearing
16. Oil seal
17. Drive sprocket
18. Drive sprocket retainer
19. Ball bearing
20. Counter shaft
21. Third drive gear
22. Second drive gear
23. Fourth drive gear
24. Thrust washer
25. Fifth drive gear
26. Bearing

CRANKCASE AND GEARBOX. Four drain plugs are located on bottom of engine case. Two plugs at rear of engine (A—Fig. S11-11) should be removed to drain gearbox lubricant. Two forward plugs (C) are crankcase drains. Shift cam stopper bolt (B) need not be removed. Engine may be removed for disassembly after draining oil. Remove heads, cylinders, engine side covers, clutch assembly and shifter components. Crankcase securing bolt holes are numbered indicating proper tightening sequence for reassembly. Remove bolts in reverse order, #18 first, to prevent warpage of case halves.

Reassemble transmission in upper crankcase half. Make certain that all retaining clips and dowel pins are correctly aligned and that no foreign material is obstructing oil passages in cases. Use tightening sequence on crankcase when reassembling. Torque 6 MM bolts to 7 Ft.-Lbs. and 8 MM bolts to 14 Ft.-Lbs.

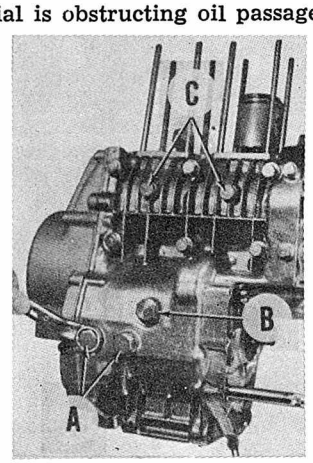


Fig. S11-11—View of lower engine case showing location of oil drain plugs (A), shift cam stopper bolt (B) and crankcase drain plugs (C).

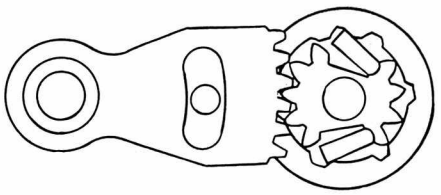


Fig. S11-12—Shift shaft arm must be aligned with side of shift pawl holder with five teeth.

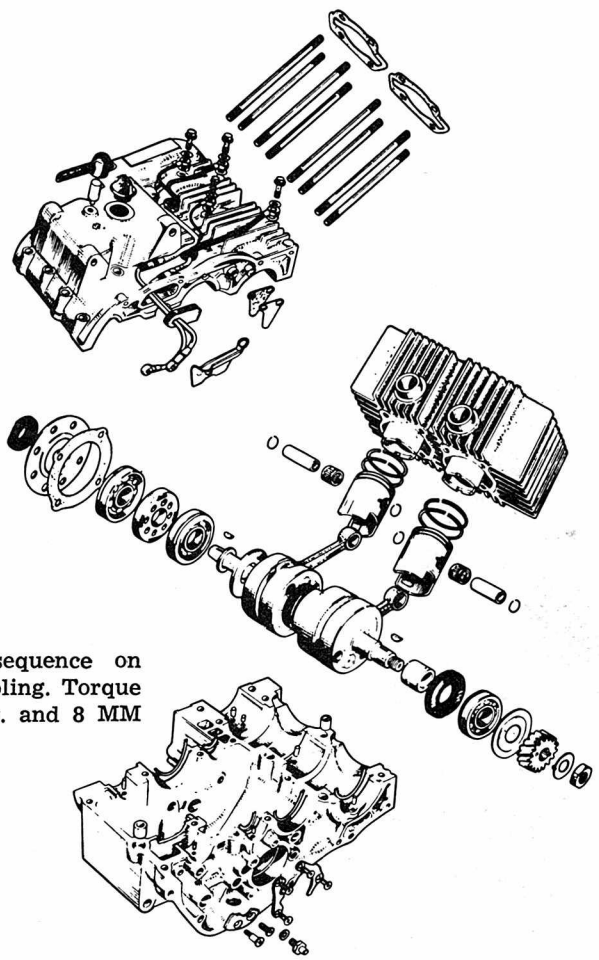


Fig. S11-13 — Crankcase and crankshaft assembly common to all models.

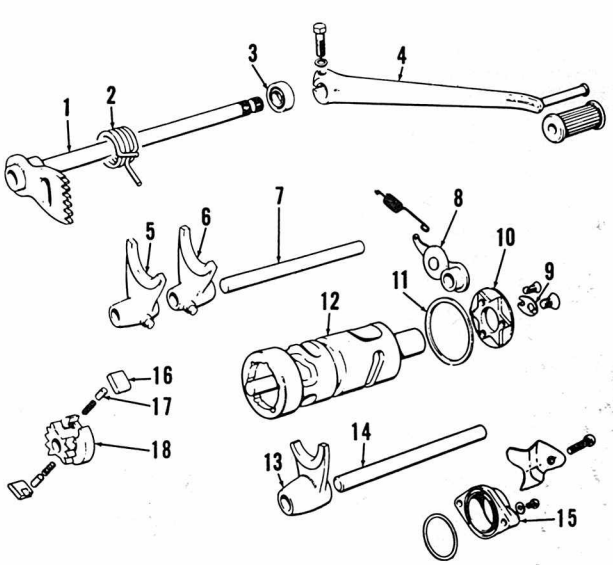


Fig. S11-14 — Component parts of shifter assembly common to all models.

1. Shift shaft
2. Shift return spring
3. Oil seal
4. Shift lever
5. Second gear shift fork
6. Fifth gear shift fork
7. Shift fork shaft
8. Shift cam stopper
9. Neutral switch
10. Shift cam stopper plate
11. Thrust washer
12. Shift cam
13. Second drive gear shift fork
14. Shift fork shaft
15. Neutral switch cover
16. Shift pawl
17. Shift pawl roller
18. Shift pawl holder

SUZUKI 250CC SINGLE CYLINDER

MODEL	Savage TS 250 TS 250 II	Savage TS 250 R
Displacement—cc	246	246
Bore—MM	70	70
Stroke—MM	64	64
Number of cylinders	1	1
Oil-Fuel ratio	Oil Injection	
Plug gap—inch	0.024-0.028	0.024-0.028
Point gap—inch	0.012-0.016	None
Ignition timing	Fixed	Auto-Advance
Degrees BTDC—Advanced	21	24
Degrees BTDC—Retarded	21	16
Electrical system voltage	6	6
Battery terminal grounded	Negative	Negative
Tire size—Front	3.25x19	3.25x19
Rear	4.00x18	4.00x18
Tire pressure—Front	17 PSI	21 PSI
Rear	20 PSI	26 PSI
Rear chain free play—inch	¾-1	¾-1
Number of speeds	5	5
Weight—Lbs. (approx.)	279*	260

*Weight of TS 250 II is 272 Lbs.

MAINTENANCE

SPARK PLUG. Recommended spark plug for normal use is the NGK type B-7E in contact breaker models and a B-7ES in PEI ignition models. A Champion type N-5 or N-88 may be used in place of a B-7E and an N-4 may be used in place of a B-7ES. Recommended spark plug electrode gap is 0.024-0.028 inch. An NGK type B-8E or B-8ES or equivalent plug is recommended for extended high speed operation.

CARBURETOR. All models use a Mikuni 28 MM sliding valve carburetor. Refer to Fig. S12-1 and the following specifications:

TS 250 (VM 28 SC Spigot Mount Carburetor)

Main jet (15) .....#115
Pilot jet (13) 25
Jet needle (6) .....5 EP 6
Needle jet (8) P-2
Throttle valve (7) 2.0
Clip (5) in third groove from top of needle (6).

TS 250 II (VM 28 SC Spigot Mount Carburetor)

Main jet (15) .....#117.5
Pilot jet (13) 25
Jet needle (6) .....5 DP 10
Needle jet (8) P-0
Throttle valve (7) 2.0
Clip (5) in second groove from top of needle (6).

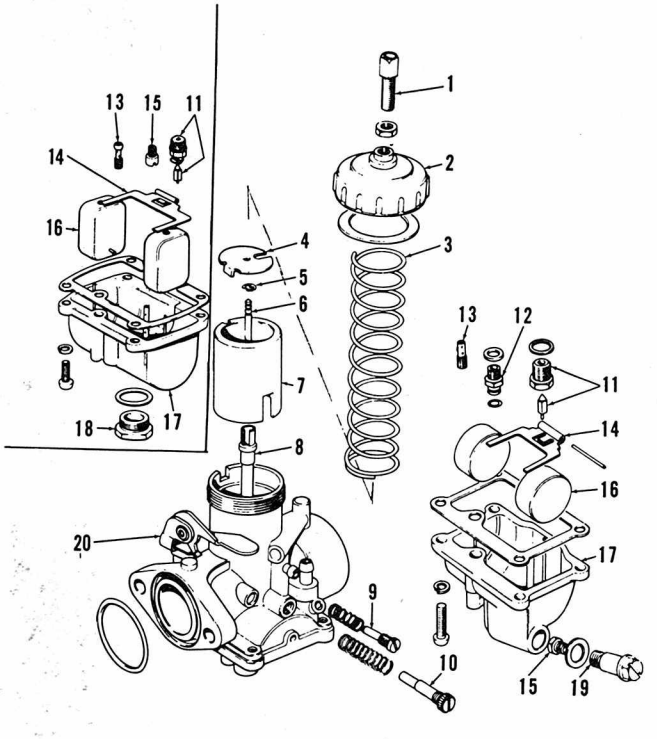


Fig. S12-1 — Exploded view of carburetor used on TS 250 R. Inset shows float assembly used on early models.

1. Throttle cable adjuster
2. Mixing chamber cap
3. Throttle return spring
4. Spring seat
5. Jet needle clip
6. Jet needle
7. Throttle slide
8. Needle jet
9. Pilot air screw
10. Idle speed adjuster
11. Float valve assembly
12. Fuel passage
13. Pilot jet
14. Float arm
15. Main jet
16. Float
17. Float chamber
18. Float chamber drain plug
19. Main jet holder
20. Starter lever

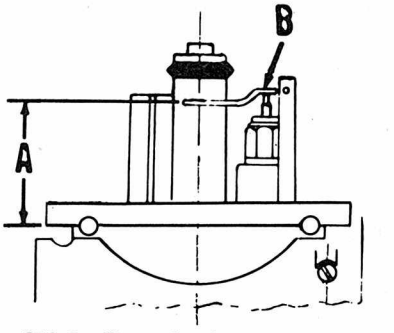


Fig. S12-2—Float level on some early models is checked by measuring from float arm to gasket surface of float bowl with gasket removed. Adjust level by bending tang (B).

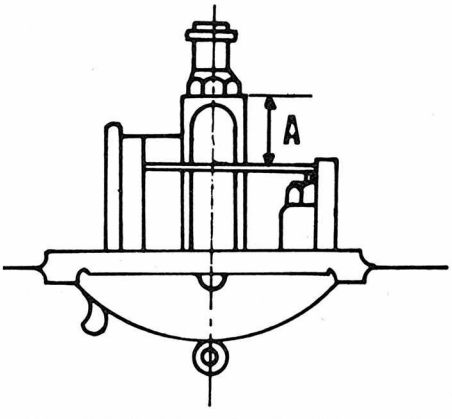


Fig. S12-3—Float level (A) on later models is checked by measuring from float arm to jet holder boss with mixing chamber body inverted.

TS 250 R (VM 28 SH Flange Mount Carburetor)

Main jet (15) .....#170
Pilot jet (13) 25
Jet needle (6) .....5 CN 3
Needle jet (8) 0-4
Throttle valve (7) 2.5
Clip (5) in second groove from top of needle (6).

Pilot air screw (9) should be 1½ turns out from a lightly seated position on SC type carburetors and 1¾ turns out on SH type units. Final adjustment of air screw should be within ¼ turn of standard setting. Float level should be 28 MM (1.1 inch) on units with one piece float/float arm assembly. Level on these units is measured from bottom of float with carburetor inverted to gasket surface of mixing chamber body with gasket removed. Float level (A—Fig. S12-2) should be 23 MM (0.90 inch) on TS 250 (VM 28 SC) units with separate floats and float arm. Float level (A—Fig. S12-3) should be 15 MM (0.59 inch) on TS 250 R (VM 28 SH) models. Level on all models is adjusted by bending tang (B—Fig. S12-2).

IGNITION AND ELECTRICAL. A 6V 2 AH battery is common to all models. A rectifier is fitted to convert AC current to DC. All electrical parts on PEI models are DC operated while earlier models use DC current for horn, turn signals and brake light only.

An ohmmeter or simple continuity tester may be used to inspect the rectifier. When test leads are installed on rectifier, indicator should show continuity in one direction and not in the other. If current flows in both directions or not at all, unit is faulty.

IGNITION INSPECTION AND ADJUSTMENT OF CONTACT BREAKER MODELS. Inspect breaker points for burning or wear. Clean and set maximum point gap to 0.012-0.016 inch. Ignition should occur (points just open) at 21 degrees BTDC. Piston will be 2.7 MM (0.106 inch) BTDC and mark on flywheel will align with punch mark on crankcase at this time. Timing marks are at approximately same position as on PEI model in Fig. S12-5.

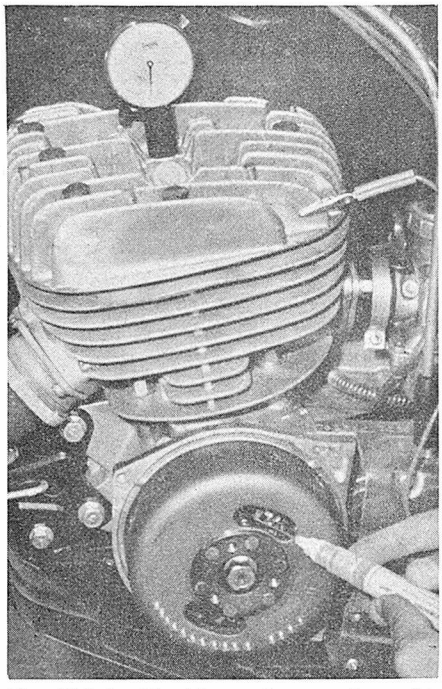


Fig. S12-4—Checking point opening with a dial gage and static timing light. Gage shown is available from Central Tool Co.

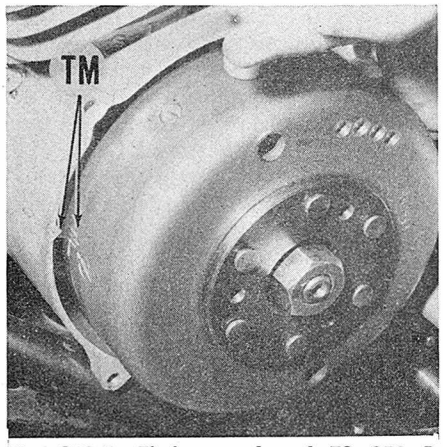


Fig. S12-5—Timing marks of TS 250 R model. Use a power timing light and an engine speed of 4000 RPM to check PEI models.

IGNITION INSPECTION AND ADJUSTMENT OF PEI (POINTLESS ELECTRONIC IGNITION) MODELS. The TS 250 R is equipped with a capacitor discharge ignition system. After initial installation, further adjustment should not be necessary, however, timing may be inspected with a power timing light. Timing marks (TM—Fig. S12-5) should align at 4000 RPM. If stator plate has been removed, timing may be reset by installing base plate (1—Fig. S12-6) with stamped line on plate aligned with center of mounting screw (2). Recheck with power timing light after installation.

As the PEI magneto flywheel (Fig. S12-7) turns, a current is induced in the exciter coil (approximately 100-300 V). This current is rectified by diode "A" and stored in the condenser (capacitor). As the flywheel rotates a current is also produced in the trigger coil. This trigger current is rectified by diode "B" and channeled through the trigger signal control circuit. The trigger signal is delayed in the control circuit by a Zener diode until sufficient voltage is produced (depending on engine RPM) to release the trigger signal to the thyristor. When trigger voltage is introduced to the thyristor, current in the condenser is released to the ignition coil and ignition spark follows.

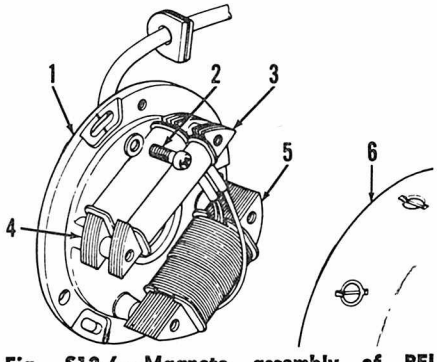


Fig. S12-6—Magneto assembly of PEI models. Center of screw (2) should be aligned with punch marks on base plate (1).

1. Base plate
2. Screw
3. Trigger coil
4. Exciter coil
5. Lighting coil
6. Flywheel

Some parts of the system may be inspected with an ohmmeter. Resistance of the exciter coil (4—Fig. S12-6) should be 220 ohms and is measured between the black/red wire and plate (1). Standard resistance of trigger coil (3) is 75 ohms checked between the red/white wire and base plate. Standard resistance of primary winding of ignition coil (measured between black/white and white/blue wire) is approximately 0.7 ohms. Resistance of secondary winding (spark plug lead to ground) is approximately 12,000 ohms.

The following checks are all made to the PEI unit (located under seat) with an ohmmeter. Connect one lead from ohmmeter to black/yellow wire and other lead to black/white wire, reverse leads. Current should flow in one direction and not in the other. Place leads on black/red and black/yellow leads from box. There should be continuity in one direction and approximately 2 Meg ohms resistance in other direction. Connect meter leads to black/white wire and red/white wire. There should be no continuity in one direction and 100-500 ohms in the other direction. Finally, connect leads to black/yellow and white/blue wires. Meter should bounce across scale and return to original position. If any of the previous checks do not test as indicated, unit must be renewed.

LUBRICATION. Gearbox capacity of TS 250 and TS 250 II models is 1.2 qt. Capacity of TS 250 R is 0.74 qt. All models should be serviced with 20W/40 motor oil. Drain and renew transmission lubricant every 3000 miles.

Engine lubrication on all models is accomplished by an automatic oil metering system. Only oils intended for use in air cooled two cycle engine should be used. Oil is pumped in direct relation to engine speed and

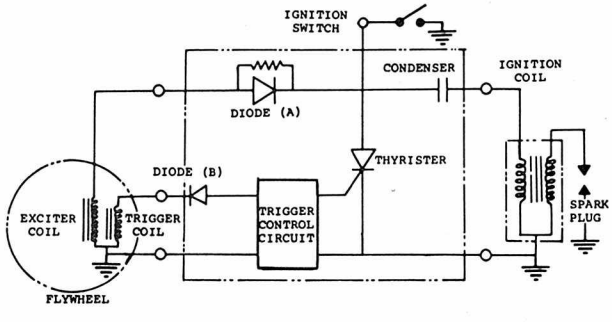


Fig. S12-7 — Simplified diagram of PEI system used on the TS 250 R.

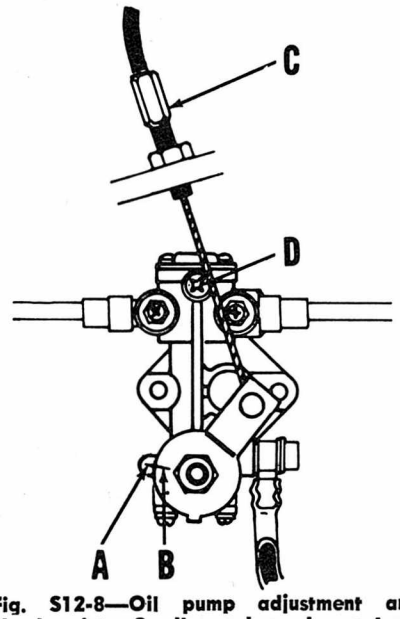


Fig. S12-8—Oil pump adjustment and bleed points. Small punch marks on lever are factory reference marks and should not be used as aligning marks.

amount of throttle opening to the intake port and left crankshaft main bearing. Transmission oil is used to lubricate right main bearing. On early models (TS 250 and TS 250 II) the oil pump is driven by the primary gear and located on right side of engine. Later units (TS 250 R) mount oil pump on left side of engine to the rear and drive through the kick-starter. Adjustments on all models are similar.

Turn cable adjuster (C—Fig. S12-8) so that aligning marks (A&B) align with throttle wide open.

If oil pump has been removed or allowed to run dry, it will be necessary to bleed the injection system. Pump and main inlet line are bled by loosening bleeder screw (D) and allowing oil to flow until air bubbles are no longer present in oil coming from bleeder hole. Air in pressure lines is expelled by holding oil pump control arm full on and running engine at idle until air is removed.

CLUTCH CONTROLS. Clutch may be adjusted after removing adjustment cover on left engine case. Loosen lock nut (18—Fig. S12-10) and turn adjusting screw (17) until it just contacts push rod (14). Back adjusting screw out ½ turn and tighten lock nut. Turn adjusters on clutch control cable to obtain ⅛ inch free play at pivot of clutch lever on handle grip.

SUSPENSION. Front suspension units on early (TS 250 and TS 250 II) models contain 250cc of oil each and units on later (TS 250 R) models contain 255cc of oil each. Oil used in all models should be SAE 30 motor

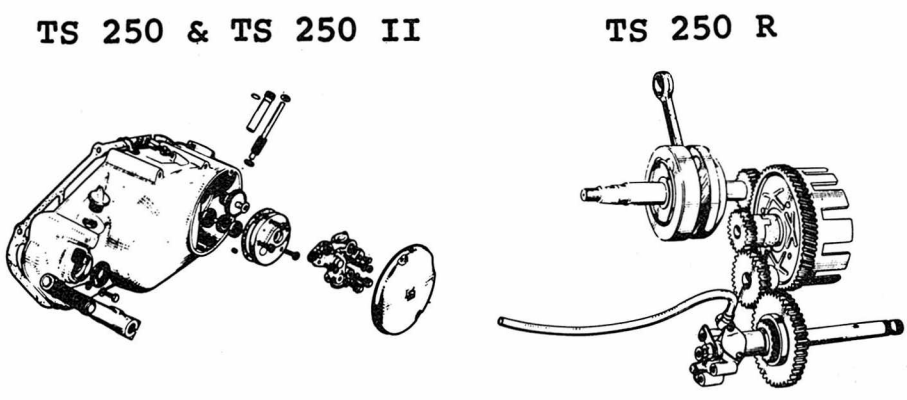


Fig. S12-9—Different oil pump drives used on the Suzuki Savage. Oil pump on TS 250 R is located on left side of engine to the rear.

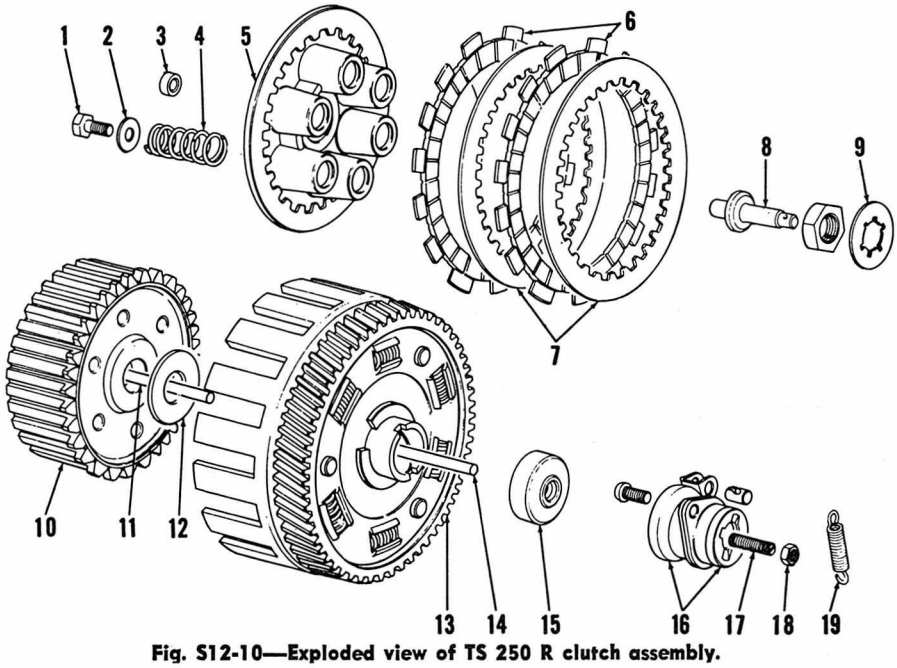
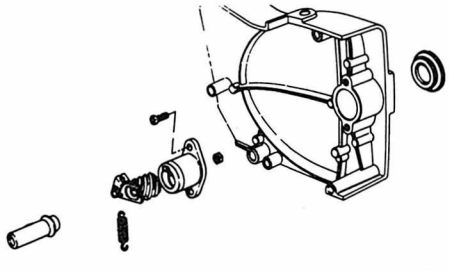


Fig. S12-10—Exploded view of TS 250 R clutch assembly.

1. Bolt
2. Washer
3. Oil seal
4. Clutch spring
5. Pressure plate
6. Friction discs (6 used)
7. Steel plates (6 used)
8. Push piece
9. Lock washer
10. Clutch hub
11. Push rod
12. Thrust washer
13. Primary driven gear assembly
14. Push rod
15. Oil seal
16. Release screw assembly
17. Adjusting screw
18. Lock nut
19. Release screw return spring



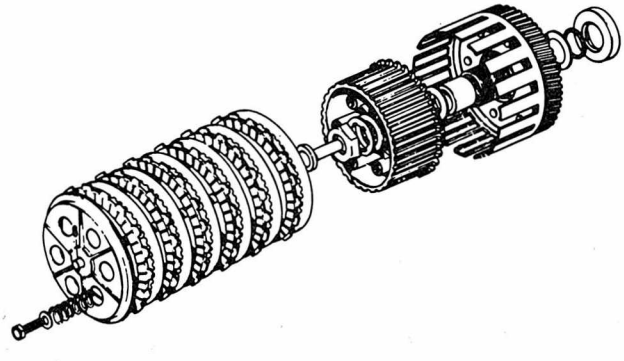


Fig. S12-11—Clutch assembly used on early model TS 250. Basic parts are similar to TS 250 R unit in Fig. S12-10.

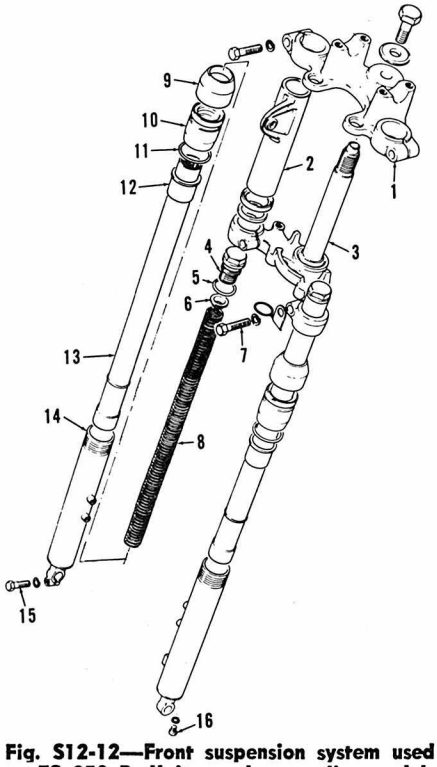


Fig. S12-12—Front suspension system used on TS 250 R. Units used on earlier models are similar.

1. Steering stem head
2. Fork inner tube cover
3. Steering stem
4. Fork top bolt
5. "O" ring
6. Spring guide
7. Pinch bolt
8. Fork spring
9. Dust cover
10. Outer tube nut
11. "O" ring
12. Metal slide
13. Fork inner tube
14. Fork outer tube
15. Axle pinch bolt
16. Oil drain plug

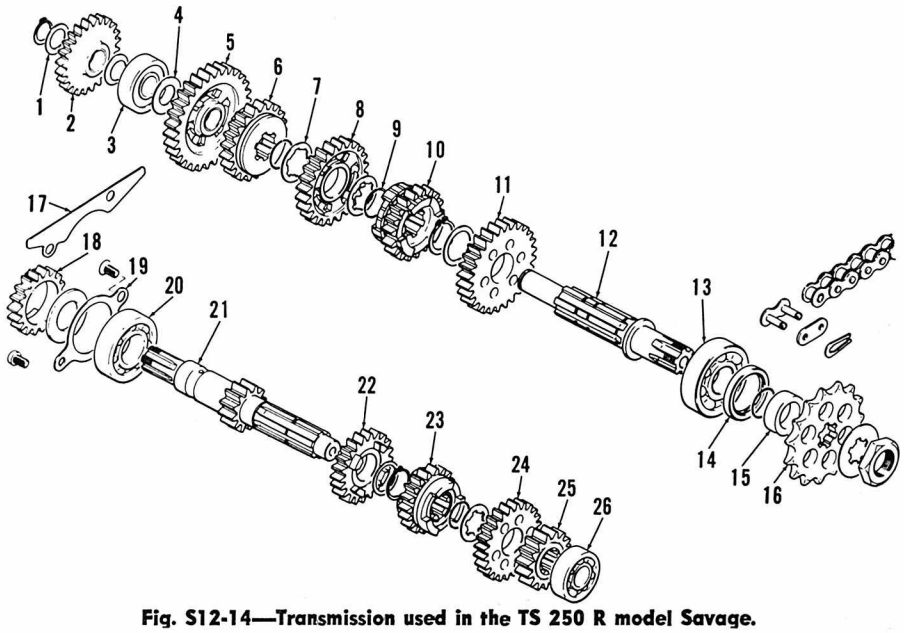


Fig. S12-14—Transmission used in the TS 250 R model Savage.

1. Wave washer
2. Kick starter idle gear
3. Ball bearing
4. Thrust washer
5. First driven gear
6. Fourth driven gear
7. Washer
8. Third driven gear
9. Retaining clip
10. Fifth driven gear
11. Second driven gear
12. Drive shaft
13. Ball bearing
14. Oil seal
15. Spacer
16. Drive sprocket
17. Oil reservoir plate
18. Kick starter driven gear
19. Bearing holder
20. Ball bearing
21. Counter shaft
22. Fourth drive gear
23. Third drive gear
24. Fifth drive gear
25. Second drive gear
26. Ball bearing

oil. Inner fork tubes (13—Fig. S12-12) should extend 5 MM ($\frac{3}{16}$ in.) beyond top of upper triple clamp (A—Fig. S12-13) on TS 250 and TS 250 II models. Inner fork tube should be mounted flush with top of clamp on TS 250 R models.

Rear suspension units are not repairable and should be renewed if leaking or damaged.

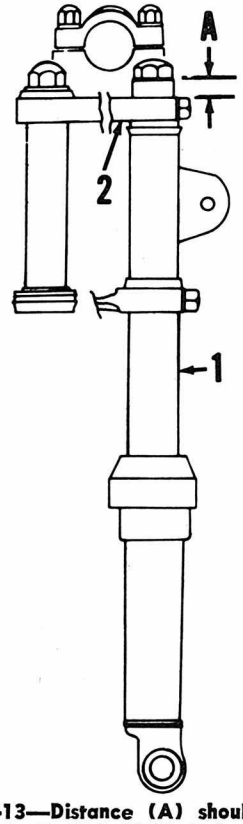


Fig. S12-13—Distance (A) should be approximately 5 MM (0.20 inch) on early models. TS 250 R models should have fork inner tube (1) top level with top of steering head (2).

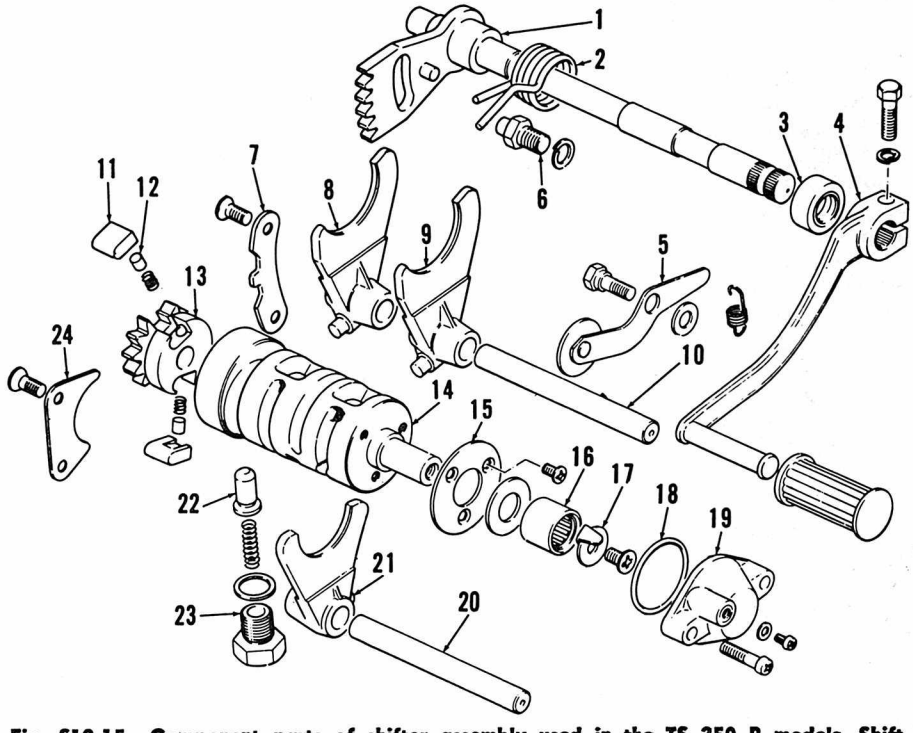


Fig. S12-15—Component parts of shifter assembly used in the TS 250 R models. Shift forks (8 & 9) are interchangeable.

1. Shift arm
2. Shifter return spring
3. Oil seal
4. Shift lever
5. Shift cam stopper
6. Shift shaft stopper
7. Shift cam guide
8. Gear shift fork
9. Gear shift fork
10. Shift fork shaft
11. Shift pawl
12. Shift pawl roller
13. Cam gear
14. Shift cam
15. Cam stopper plate
16. Needle bearing
17. Neutral switch
18. "O" ring
19. Neutral switch cover
20. Shift fork shaft
21. Shift fork
22. Shift cam stopper
23. Shift cam stopper spring holder

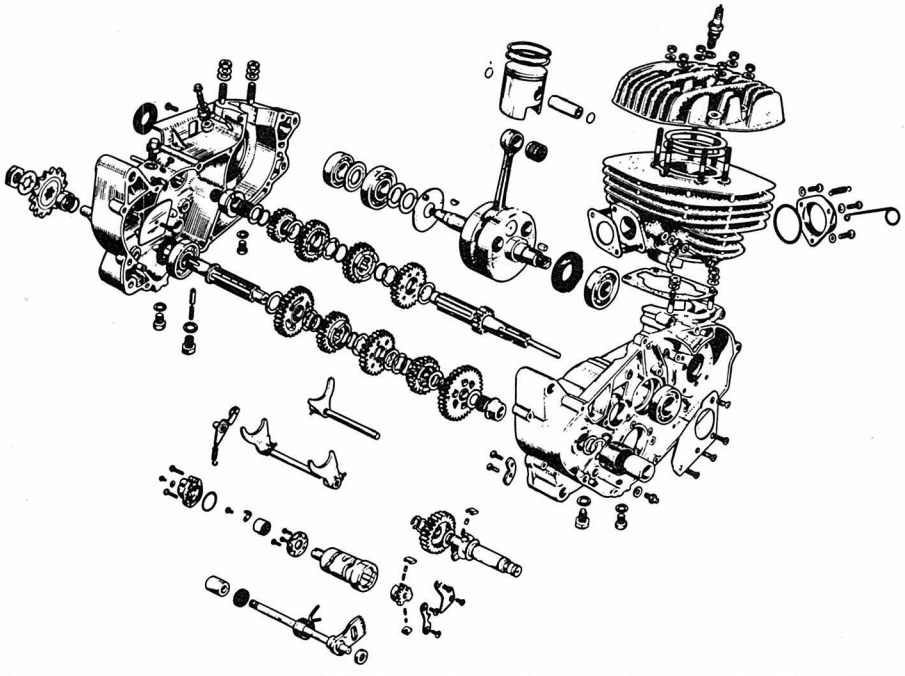


Fig. S12-16—Exploded view of TS 250 engine and transmission assembly. Minor differences may be seen between this unit and TS 250 R model.

REPAIRS

PISTON, RINGS AND CYLINDER. Cylinder and piston may be removed without dismounting engine from frame. Head retaining nuts should be loosened and tightened diagonally to prevent head warpage. Refer to the following repair specifications:

Maximum cylinder taper or out of round .....0.002 inch
Piston skirt to cylinder clearance—
(TS 250 & TS 250 II)..0.0071-0.0074 inch
(TS 250 R) .....0.0026-0.0030 inch
Piston ring end gap—
Standard .....0.0059-0.0138 inch
Limit ..... 0.04 inch

Piston should be installed with arrow on dome toward front (exhaust side) of engine. Measure piston two inches from bottom at a right angle to pin hole for cylinder clearance check. Pistons and rings are available in standard and two oversizes. Piston rings are Keystone type and must be installed with markings toward top. Piston made for TS 250 R should not be installed in earlier models. Torque head retaining nuts to 14.5 Ft.-Lbs. using a diagonal pattern.

CRANKSHAFT AND CONNECTING ROD. Engine must be removed from frame and crankcase separated to remove crankshaft assembly. Maximum eccentricity of crankshaft is 0.0023 inch with crankshaft supported on "V" blocks. Maximum shake at small end of connecting rod is 0.118 inch. Torque primary gear retaining nut to 36 Ft.-Lbs.

CLUTCH. The wet type multi disc unit is located on the transmission drive shaft at the right side of engine. Standard thickness of friction discs (6—Fig. S12-10) is 0.138 inch. Discs should be renewed if less than 0.126 inch thick. Steel plates (7) should be renewed if warped more than 0.016 inch. Standard free length of clutch springs (4) is 1.51 inch and springs should be renewed if less than 1.46 inches long.

CRANKCASE AND GEARBOX. Crankcase halves must be separated to remove the transmission. Cases should be thoroughly cleaned before reassembly and a non hardening type gasket sealer used. TS 250 R model is only unit that is equipped with a gasket between crankcase halves.

Kick starter lever and kick starter shaft on early models have punch marks that should be aligned on reassembly.

SUZUKI CYCLONE

MODEL	TM 400R
Displacement—cc	396
Bore—MM	82
Stroke—MM	75
Number of cylinders	1
Oil-Fuel ratio	Oil Injection*
Plug gap—inch	0.024-0.028
Ignition timing—Advance	Automatic
Degrees BTDC—Retarded	8 @ 1000 RPM
Degrees BTDC—Advanced	24 @ 6000 RPM
Tire size—Front	3.00x21
Rear	4.00x18
Tire pressure—Front	17 PSI**
Rear	20 PSI**
Rear Chain free play—inch	0.6-0.8
Number of speeds	5
Weight—Lbs. (approx.)	236

* A 20:1 fuel to oil mixture should be used for one fuel tank full on a freshly overhauled engine.
** 14 PSI recommended for both tires when operating on loose earth or mud.

MAINTENANCE

SPARK PLUG AND IGNITION. The manufacturer recommends use of an NGK racing type B-8ES spark plug with an electrode gap of 0.024-0.028 inch. Some recommended replacements for NGK plugs are an Autolite type AG2 or a Champion type N3.

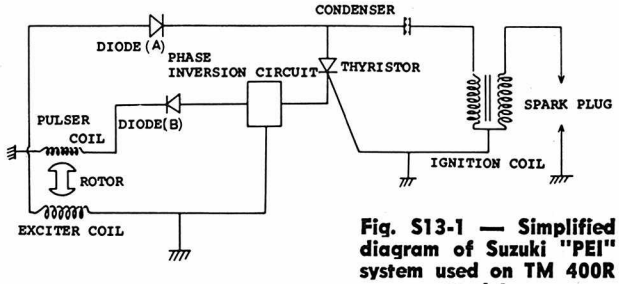


Fig. S13-1 — Simplified diagram of Suzuki "PEI" system used on TM 400R models.

Suzuki's PEI (Pointless Electronic Ignition) system is used on TM 400R models. A magneto mounted at left end of crankshaft is used to produce the current needed for ignition and to time the ignition signal. As magneto rotor (Fig. S13-1) turns, a current is induced in the exciter coil. This current is rectified by diode (A) and stored as 100-160 DC volts in the

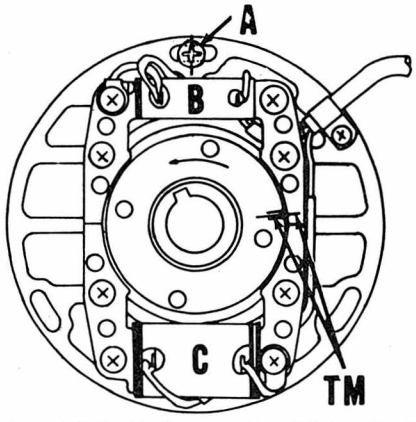


Fig. S13-2—Timing marks (TM) should align at 3000 RPM.

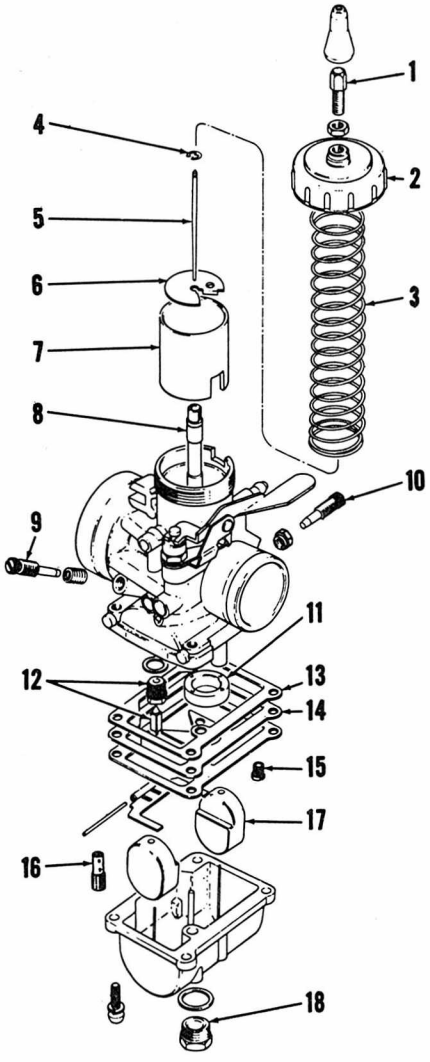


Fig. S13-3—Exploded view of carburetor used on TM 400R.

1. Throttle cable adjuster
2. Mixing chamber cap
3. Throttle return spring
4. Jet needle clip
5. Jet needle
6. Spring plate
7. Throttle slide
8. Needle jet
9. Pilot air screw
10. Idle speed screw
11. Main jet ring
12. Float valve
13. Float chamber gasket
14. Float chamber plate
15. Main jet
16. Pilot jet
17. Float
18. Float chamber drain plug

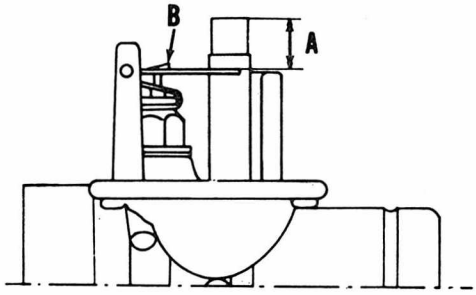


Fig. S13-4—Float level (A) may be adjusted by bending tang (B).

condenser. As the rotor continues to turn a voltage is created in the pulser coil. This voltage is rectified by diode (B) and used as a timing signal to trigger the thyristor which, when activated, allows all current stored in condenser to enter the high tension coil primary winding.

Ignition timing may be checked with a power timing light. Timing marks (TM—Fig. S13-2) should align at 3000 RPM. Timing should be correct if center of mounting screw (A) is aligned with stamped mark on stator.

Various components of the system may be inspected with an ohmmeter. Resistance of the exciter coil (C—Fig. S13-2) should be 315 ohms and is measured between the black/red wire and base plate. Standard resistance of the pulser coil (B) is 80 ohms, checked between the red/white wire and the base plate. Standard resistance of primary winding of ignition coil (measured between black/white and white/blue wire) is approximately 1.5 ohms. Resistance of secondary winding (spark plug lead to ground) is approximately 20,000 ohms.

The following checks are all made to the PEI control unit (located under seat) with an ohmmeter. Connect one lead from meter to red/white wire and other lead to black/white wire, reverse leads, current should flow in one direction and not in other. Perform same test with black/white and black wire. Current should flow in one direction and not in the other. Place test leads on black and black/red leads from PEI box. There should be continuity in one direction and approximately 2 Meg ohms resistance in other direction. Finally, connect test leads to black and white/blue wires from PEI box. Meter should bounce across scale and return to original position. If any of the described checks did not test as indicated, unit is defective and should be renewed.

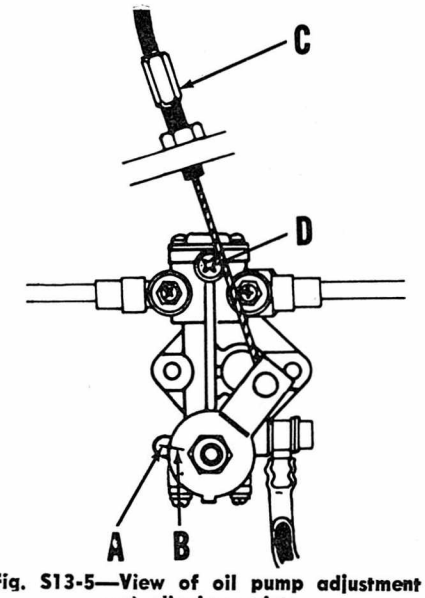


Fig. S13-5—View of oil pump adjustment and aligning points.

CARBURETOR. A Mikuni VM34SC is used on TM 400R models. Initial setting of pilot air screw (9—Fig. S13-3) is 1½ turns out from a lightly seated position. The following standard specifications are used (See Fig. S13-3).

Main jet (15) .....#310
Jet needle (5) 6FJ 6
Needle jet (8) Q-8
Pilot jet (16) .....#35
Throttle slide (7) 2.0
Clip (4) in third groove from top of needle (5).

Float level (A—Fig. S13-4) should be $\frac{13}{32}$ inch (10.5 MM) and is adjusted by bending tang (B).

LUBRICATION. Transmission should be serviced with 1.16 Qt. of SAE 20W/40 motor oil Fluid should be drained and renewed after five races or approximately 300 miles. Oil level may be checked by removing hex head bolt from right forward side of engine case (fluid should just reach level of bolt).

Engine lubrication is accomplished by an automatic oil metering system. Two cycle engine oil stored in a separate tank, is pumped and metered to the left crankshaft main bearing and intake port. Right crank main is lubricated by transmission oil.

Break in and severe use require a 20:1 fuel-oil mixture be used in fuel tank in addition to the automatic lubrication system.

Due to the rapid oil consumption and small size of oil container, refill oil tank with each refueling.

Turn oil pump adjuster (C—Fig. S13-5) so that marks (A & B) align with throttle full on. In the event pump has run dry or been removed,

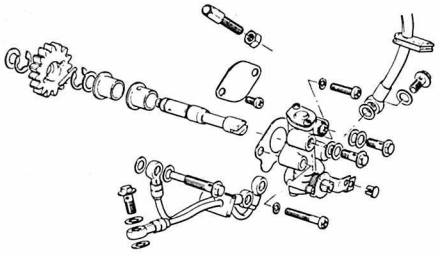


Fig. S13-6—Exploded view of oil pump and related parts.

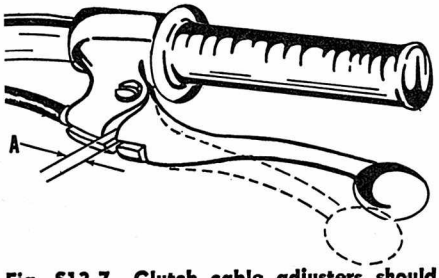


Fig. S13-7—Clutch cable adjusters should be turned to obtain 5/32 inch free play at (A).

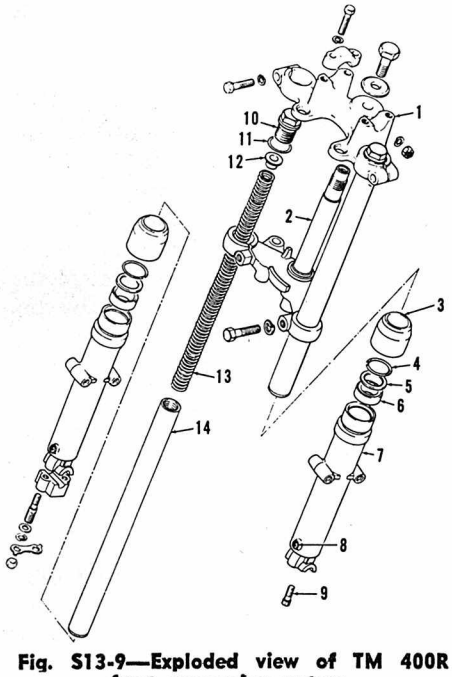


Fig. S13-9—Exploded view of TM 400R front suspension system.

1. Fork top clamp
2. Steering stem
3. Dust cover
4. Retaining clip
5. Washer
6. Oil seal
7. Outer tube
8. Oil drain screw
9. Damper holding bolt
10. Fork top bolt
11. "O" ring
12. Spring guide
13. Fork spring
14. Inner fork tube

it will be necessary to bleed all air from system. Loosen bleed screw (D) and allow oil to flow until air bubbles are no longer present. Air may be expelled from pressure lines by removing screws in banjo bolts of pressure lines and squirting two cycle oil into the fittings until air is removed.

CLUTCH CONTROLS. Turn adjusters on clutch control cable to obtain $\frac{5}{32}$ inch (4 MM) free play in lever (A—Fig. S13-7).

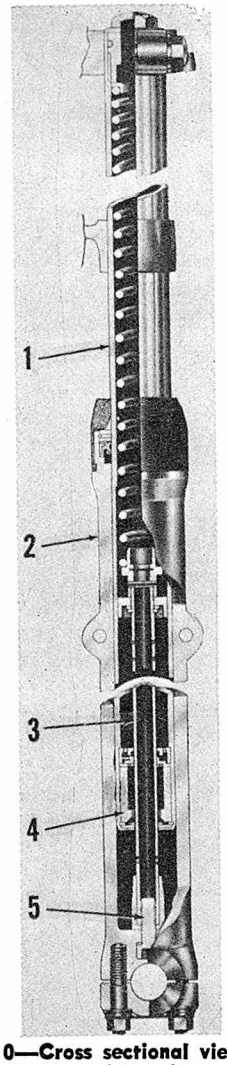


Fig. S13-10—Cross sectional view of front suspension unit.

1. Inner fork tube
2. Outer fork tube
3. Cylinder
4. Piston
5. Holding bolt

SUSPENSION. Front suspension units on TM 400R models contain 190cc of SAE 10 motor oil each. Fork oil should be drained and renewed every 10 races (approximately 600 miles). Oil is drained by removing screws (8—Fig. S13-9). Forks may be disassembled after removing bolt (9).

Rear suspension units are not repairable and should be renewed if leaking or damaged.

REPAIRS

PISTON, RINGS AND CYLINDER. Cylinder and piston may be removed without dismounting engine from frame. Refer to the following repair specifications:

Maximum cylinder taper or out of round .....0.002 inch
Standard cylinder bore diameter .....3.228-3.229 inch (82.000-82.018 MM)
Standard piston diameter .....3.2237-3.2243 inch (81.891-81.906 MM)

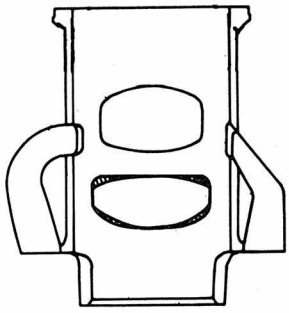


Fig. S13-11—Intake may be enlarged by removing metal from shaded areas. Do not raise top edge or lower bottom edge of port.

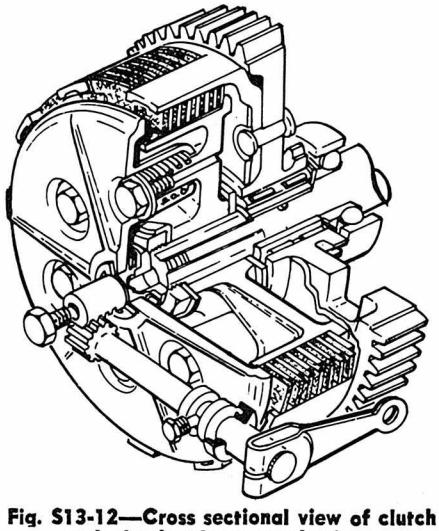


Fig. S13-12—Cross sectional view of clutch and clutch release mechanism.

Limit .....3.219 inch (81.75 MM)
Piston skirt to cylinder clearance .....0.0041-0.0046 inch (0.104-0.117 MM)
Piston ring end gap..0.008-0.016 inch (0.2-0.4 MM)
Limit .....0.04 inch (1.0 MM)

Install piston with ring locating pins toward rear (intake side) of engine. Measure piston 1.77 inch from bottom at a right angle to pin holes for cylinder clearance check. Carefully check piston pin for any signs of wear. Piston pin should be a snug **hand** fit. A new piston may be reamed slightly to allow proper fit of piston pin. If fit of piston pin is loose, renew pin or piston or both. Piston rings are keystone type and must be installed with markings on top side. Torque head retaining nuts to 14 foot pounds.

Each port must be rechamfered if cylinder is bored to an oversize. Slight increase in performance may be realized by enlarging intake port as shown in Fig. S13-11. Factory does not recommend altering port timing (raising or lowering ports) on intake or any other port. Internal surfaces of passages may be polished.

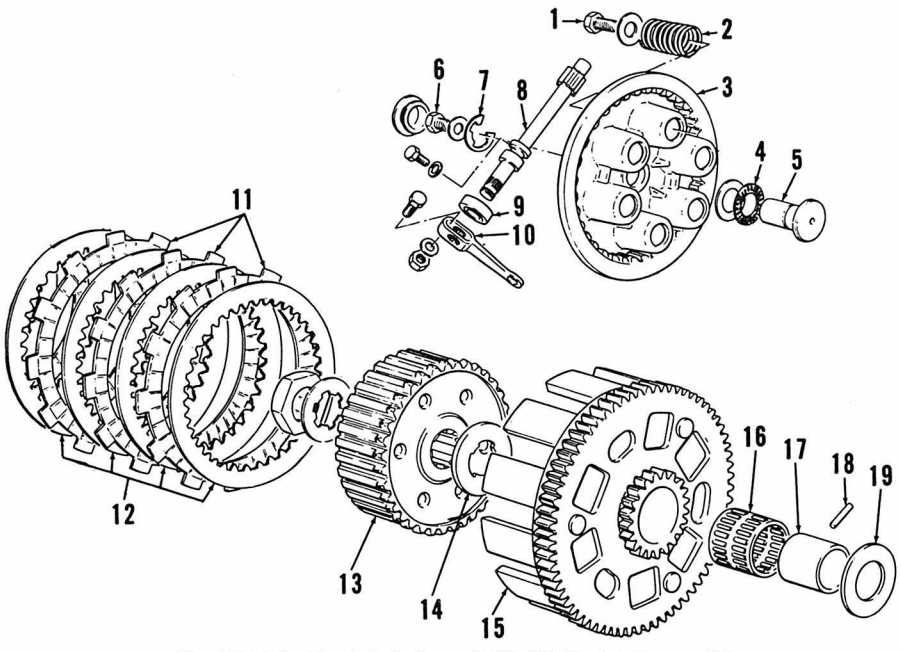


Fig. S13-13—Exploded view of TM 400 R clutch assembly.

1. Bolt
2. Clutch spring
3. Pressure plate
4. Release bearing
5. Release rack
7. Retaining clip
8. Release pinion
9. Oil seal
10. Release arm
11. Friction discs
12. Steel plates
13. Sleeve hub
14. Hub washer
15. Primary driven gear
16. Driven gear bearing
17. Spacer
18. Dowel pin
19. Washer

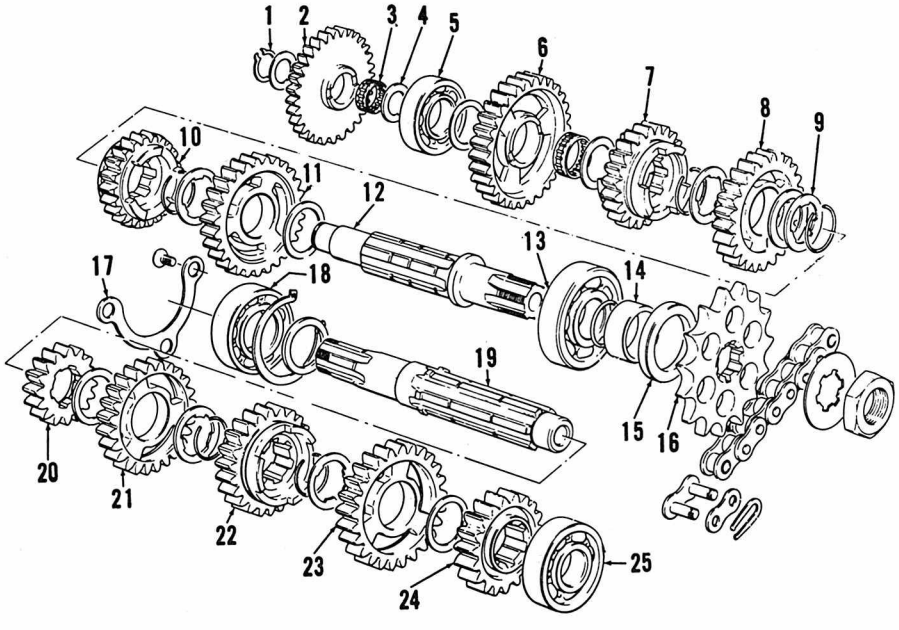


Fig. S13-14—Exploded view of transmission used in TM 400 R models. Unit should be assembled in left crankcase half.

1. Idle gear retaining clip
2. Idle gear (kick starter)
3. Needle bearing
4. Thrust washer
5. Ball bearing
6. First driven gear
7. Fourth driven gear
8. Third driven gear
9. Fourth gear washer
10. Fifth driven gear
11. Second driven gear
12. Drive shaft
13. Ball bearing
14. Sprocket spacer
15. Oil seal
16. Drive sprocket
17. Bearing retainer
18. Ball bearing
19. Counter shaft
20. First drive gear
21. Fourth drive gear
22. Third drive gear
23. Fifth drive gear
24. Second drive gear
25. Ball bearing

CRANKSHAFT AND CONNECTING ROD. Engine must be removed from frame and dismantled to remove crankshaft assembly.

Maximum eccentricity of crankshaft is 0.0024 inch with bearing surfaces resting on "V" blocks. Maximum shake measured at small end of connecting rod is 0.118 inch. Side clearance between large end of connecting rod and crank cheek should be 0.0061-0.0203 inch.

CLUTCH. The wet type multi-disc unit is mounted on right side of engine on the main transmission shaft. A rack and pinion type release is used to provide more leverage and ease operation of clutch lever.

Standard thickness of friction disc (11—Fig. S13-13) is 0.138 inch (3.5 MM). Discs should be renewed if worn thinner than 0.126 (3.2 MM) thick. Steel plates (12) should be renewed if warped more than 0.004 inch (0.1 MM). Standard free length of clutch springs (2) is 1.58 inch (40.4 MM). Springs should be renewed if less than 1.53 inch (39 MM) long. Clutch hub (13) should be renewed if step wear from steel plates is excessive on splines. Carefully inspect clutch release rack bearing (4) for wear or breakage. When fitting right crankcase cover, remove rubber plug and screw (6). Use a large screw driver to position release rack (5) for proper alignment with pinion (8).

CRANKCASE AND GEARBOX. The constant mesh, five speed transmission may be removed after separating the engine cases. Transmission cases should be heated to remove or install bearings.

Punch marks on kick starter and kick starter shaft should be aligned.

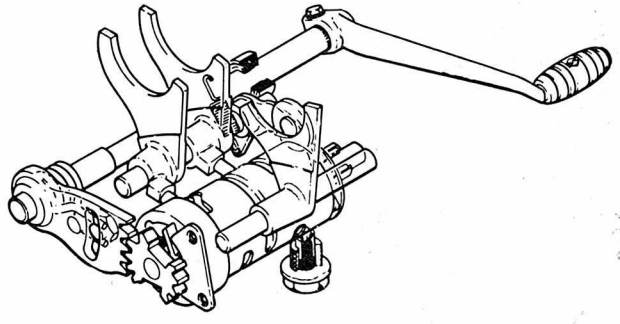


Fig. S13-15 — View of shifter components correctly aligned.

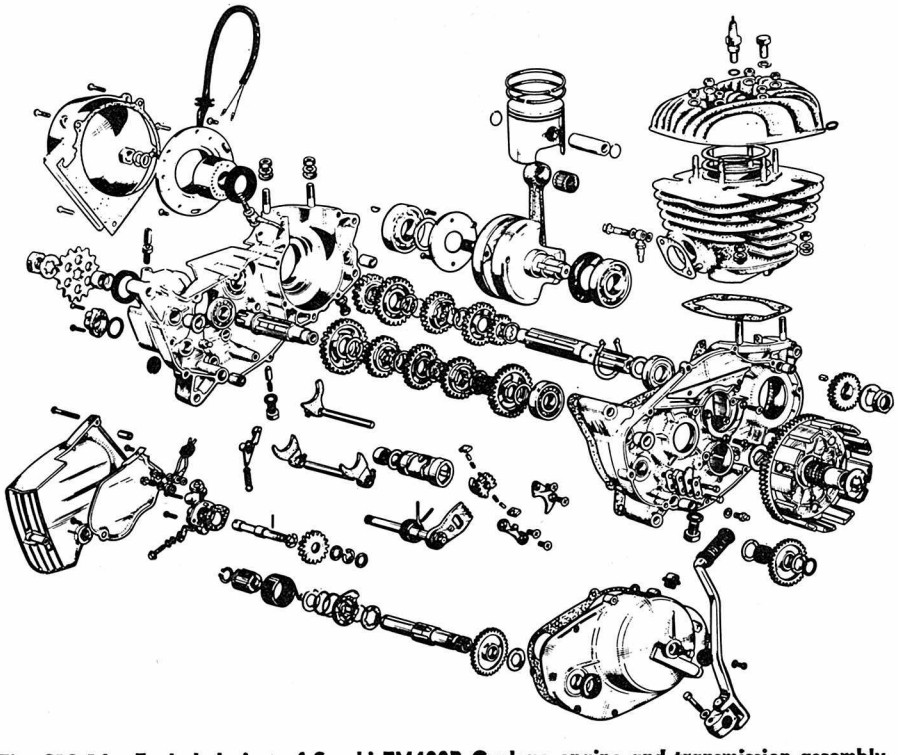


Fig. S13-16—Exploded view of Suzuki TM400R Cyclone engine and transmission assembly.

SUZUKI
125 AND 185 CC SINGLE CYLINDER MODELS

MODEL	TS 125R Duster	TS 185 R Sierra
Displacement—cc	123	183
Bore—MM	56	64
Stroke—MM	50	57
Number of cylinders	1	1
Oil-Fuel ratio	Oil Injection	
Plug gap—inch	0.018-0.020	
Point gap—inch	0.012-0.016	None
Ignition timing	Fixed	Auto-Advance
Degrees BTDC	22	16@1000 24@6000
Electrical system voltage	6	6
Battery terminal grounded	Negative	Negative
Tire size—Front	2.75x19	3.00x19
Rear	3.25x18	3.50x18
Tire pressure—Front	20 PSI	20 PSI
Rear	28 PSI	28 PSI
Rear chain free play—inch	¾-1¼	¾-1¼
Number of speeds	5	5
Weight-Lbs. (approx.)	198	218

MAINTENANCE

SPARK PLUG. Recommended spark plug for normal use is a NGK type B-77HC. A Champion type L 62 R may also be used. Electrode gap should be set at 0.018-0.020 inch on all models.

CARBURETOR. All models are equipped with 28 MM Mikuni sliding valve carburetors. Pilot air screw (10—Fig. S14-1) should be 1½ turns out from a lightly seated position for the initial setting. Float level (A—Fig. S14-2) should be a 6.8 MM (0.268 inch) and is measured by inverting mixing chamber body and checking distance from float arm to jet fitting boss. Refer to Fig. S14-1 and the following standard specifications:

TS 125 R

Main jet (17) .....#115
Jet needle (6) .....4 DH 5
Needle jet (8) 0-4
Throttle valve (7) 3.0
Pilot jet (13) 25

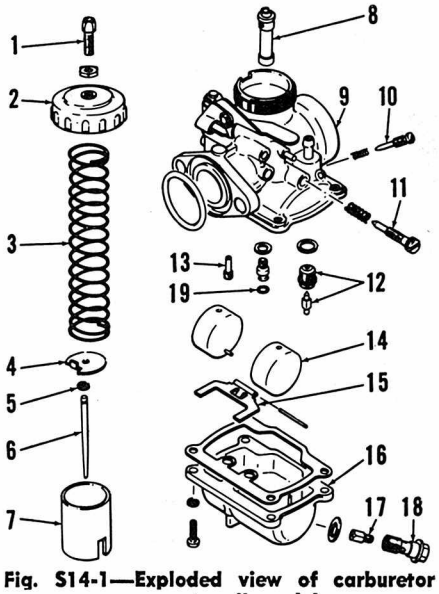


Fig. S14-1—Exploded view of carburetor common to all models.

1. Throttle cable adjuster
2. Mixing chamber cap
3. Throttle return spring
4. Spring seat
5. Needle clip
6. Jet needle
7. Throttle slide
8. Needle jet
9. Mixing chamber body
10. Pilot air screw
11. Throttle stop screw
12. Fuel valve assembly
13. Pilot jet
14. Float
15. Float arm
16. Float chamber
17. Main jet
18. Main jet plug
19. "O" ring

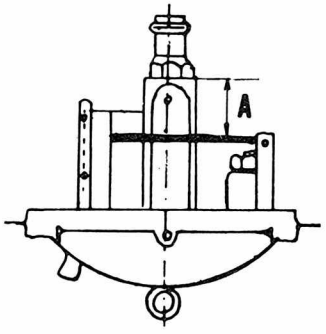


Fig. S14-2—Float level (A) is adjusted by bending portion of float arm that contacts fuel valve assembly (12—Fig. S-14-1).

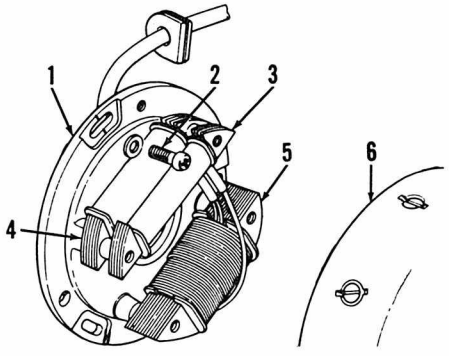


Fig. S14-4—Stator plate of TS 185 R with PEI. Align center of screw (2) with stamped mark on plate (1).

TS 185 R

Main jet (17) .....#130
Jet needle (6) .....5 DH 4
Needle Jet (8) 0-6
Throttle valve (7) 2.5
Pilot jet (13) 25

Clip (5) in second groove from top of needle (6) on all models. Main jet is changed by removing holder (18) and unscrewing jet (17) from holder.

If float bowl is removed, take care to prevent damage to "O" ring (19).

IGNITION AND ELECTRICAL. All models are equipped with a 6V 4AH battery. A rectifier is fitted to convert AC current to DC for battery charging and most lighting needs. The headlight and instrument lights are AC operated.

ADJUSTMENT AND INSPECTION OF CONTACT BREAKER IGNITION UNITS (TS 125 R MODEL). Points should have the maximum gap set at 0.012-0.016 inch. Ignition should occur (points just open) at 21-23 degrees BTDC. Piston will be 2.20-2.62 MM (0.086-0.103 inch) BTDC and marks located on flywheel and left side cover will align at this time.

Primary coil, located beneath flywheel, may be inspected with an ohmmeter. Standard resistance from black /yellow to black is 1.9 ohms.

A simple continuity tester may be used to inspect the rectifier. Current should flow across rectifier in only one direction. If current flows in both directions or not at all, renew rectifier.

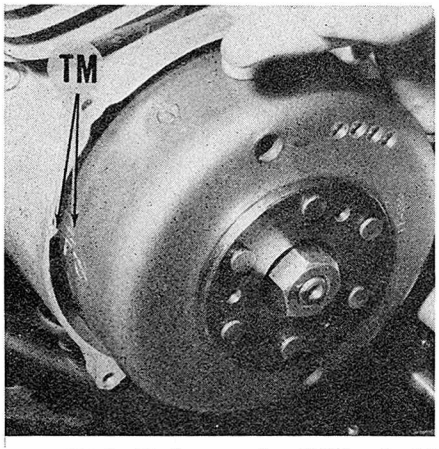


Fig. S14-3—Timing marks (TM) should align at 4000 RPM on PEI modeles.

ADJUSTMENT AND INSPECTION OF PEI (POINTLESS ELECTRONIC IGNITION) MODEL TS 185 R. The PEI system is a capacitor discharge type ignition system. After initial installation, further adjustment should not be necessary, however, timing may be checked with a power timing light. Timing marks (TM—Fig. S14-3) should align at 4000 RPM. If stator plate has been removed timing may be reset by installing base plate with stamped line on plate aligned with center of mount screw (2—Fig. S14-4). Recheck with a power timing light.

As the PEI magneto flywheel (Fig. S14-5) turns, a current is induced in the exciter coil (approximately 100-300V). This current is rectified by diode "A" and stored in the condenser (capacitor). As the flywheel rotates a current is also produced in the trigger coil. This trigger current is rectified by diode "B" and channelled through the trigger signal control curcuit. The trigger signal is delayed in control circuit by a Zener diode until sufficient voltage is produced (depending on engine RPM) to release the trigger signal to the thyristor. When trigger voltage is introduced to the thyristor, current in the condenser is released to the ignition high tension coil and ignition spark follows.

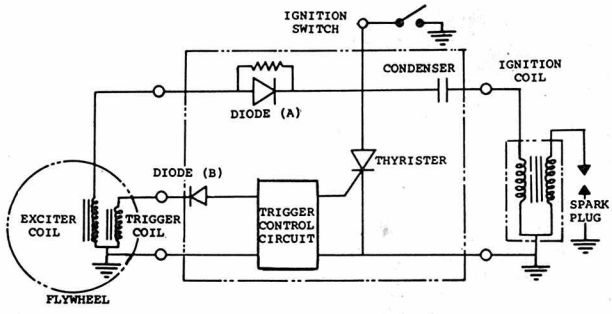


Fig. S14-5 — Simplified diagram of the PEI system.

Some parts of the system may be inspected with an ohmmeter. Resistance of the exciter coil (4—Fig. S14-4) should be 220 ohms and is measured between the black/red wire and base plate (1). Standard resistance of trigger coil (3) is 75 ohms checked between the red/white wire and the base plate. Standard resistance of primary winding of ignition coil (measured between black/white and white/blue wires) is approximately 0.7 ohms. Resistance of secondary winding (spark plug lead to ground) is approximately 12,000 ohms.

The following checks are all made to the PEI unit (located under seat) with an ohmmeter. Connect one lead from ohmmeter to black/yellow wire and other lead to black/white wire, reverse leads, current should flow in one direction and not in the other. Place leads on black/red and black/yellow leads from box. There should be continuity in one direction and approximately 2 Meg ohms resistance in other direction. Connect meter leads to black/white wire and red/white wire. There should be no continuity in one direction and 100-500 ohms in the other direction. Finally, connect test leads to black/yellow and white/blue wires. Meter should bounce across scale and return to original position. If any of the previous checks do not test as indicated, unit must be renewed.

LUBRICATION. Gear box capacity on all models is 550cc (0.58 qt.) of oil. Transmission should be drained and filled with new 20W/40 motor oil every 2,000 miles.

Engine lubrication is accomplished by an automatic oil metering system. Oil used in metering system should be type recommended for use in air cooled two stroke engines only.

Oil pump control cable should be adjusted so that marks (A & B—Fig. S14-7) align when throttle is held fully open.

If pump has been removed or allowed to run dry, it will be necessary to bleed the system. Loosen bleed screw (C) and allow oil to flow until

air is no longer present in fluid coming from hole. If air is present in pressure lines remove screws (D&E) on top of pressure fittings. Use a squirt type oil filler to purge lines of air. Make certain that all screws are tight and run engine to check for air leaks in system after bleeding operation is completed.

CLUTCH CONTROLS. Loosen clutch cable adjusters to make certain that some slack exists in linkage. Remove left side engine cover and loosen lock nut (B—Fig. S14-8). Turn adjusting screw (A) until it just contacts push rod, a slight resistance will be felt. Back adjusting screw (A) out ¼-½ turn from point of resistance and tighten lock nut (B). Turn cable adjusters to obtain approximately ⅛ inch free play in clutch lever pivot.

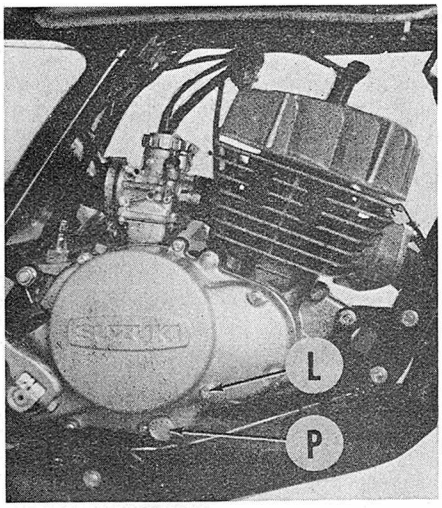


Fig. S14-6—Transmission lubricant should be maintained at level of plug (L). Remove plug (P) to drain gearbox.

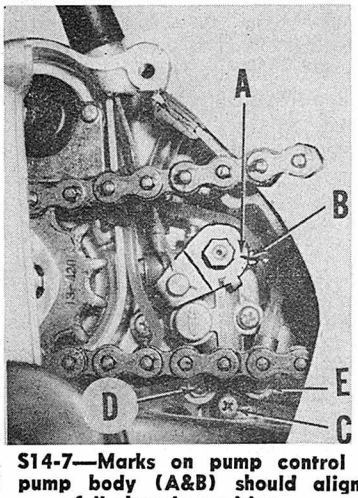


Fig. S14-7—Marks on pump control arm and pump body (A&B) should align at full throttle position.

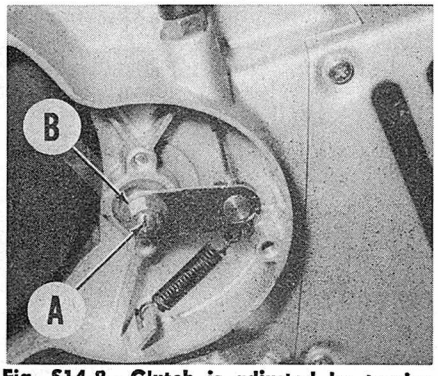


Fig. S14-8—Clutch is adjusted by turning screw (A). Make certain that lock nut (B) is tightened after adjustment.

SUSPENSION. Front suspension units on TS 185 R models contain 190cc of oil each and units on TS 125 R models contain 185cc of oil each. Oil used in all models should be SAE 30 motor oil. Fork oil may be drained by removing screw from lower end of tube (7—Fig. S14-9).

Front suspension units on TS 185 R models are adjustable to three different spring tensions. After removing rubber cap (14), spring adjusting rod (12) may be turned with a flat tip screw driver. Both adjusters should be set in same position. TS 125 R forks are similar to TS 185 R units except they are not adjustable.

Rear suspension units on all models are adjustable to five different spring tensions. Shocks are adjusted by turning the cam ring at lower end of unit. Both shocks should be adjusted to the same position.

Rear suspension units are not repairable and should be renewed if leaking or damaged.

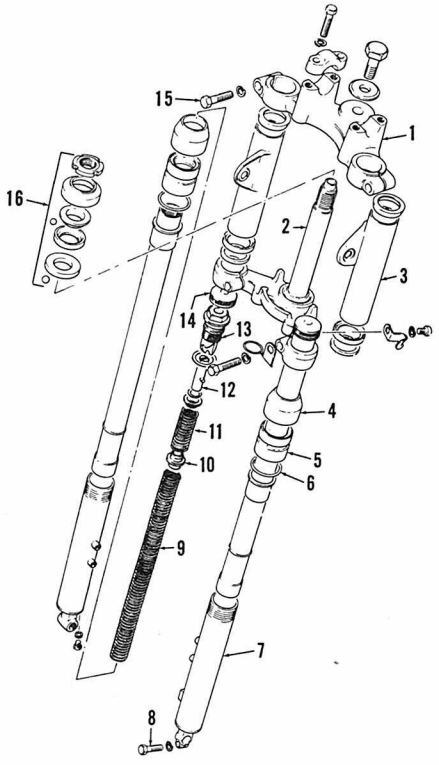


Fig. S14-9—Exploded view of front suspension units common to 185cc models. Other units are similar but lack adjusting feature.

1. Stem head
2. Steering stem
3. Inner tube cover
4. Dust cover
5. Outer tube nut
6. "O" ring
7. Outer tube
8. Axle pinch bolt
9. Lower fork spring
10. Spring spacer
11. Upper fork spring
12. Spring adjusting rod
13. Inner tube cap
14. Rubber cap
15. Fork tube pinch bolt
16. Steering stem bearing set

REPAIRS

PISTON, RINGS AND CYLINDER. Cylinder and piston may be removed without dismounting engine from frame. Refer to the following repair specifications:

Maximum cylinder taper or
out of round .....0.002 inch
Standard cylinder bore diameter—
125cc Duster..2.20472-2.20531 inches
56.0-56.015 MM
185cc Sierra ...2.5196-2.5202 inches
64.0-64.015 MM
Piston skirt to cylinder
clearance .....0.0024-0.0028 inch
Limit .....0.0097 inch
Piston ring end gap. 0.0059-0.0138 inch
Limit .....0.04 inch

Piston should be installed with arrow on dome toward front (exhaust side) of engine. Piston rings are Keystone type and must be installed with markings on the top side. Measure piston ⅞ inch from bottom at a right angle to pin hole for cylinder clearance check. Piston pin should be a snug hand fit in piston. Pistons and rings are available in standard and

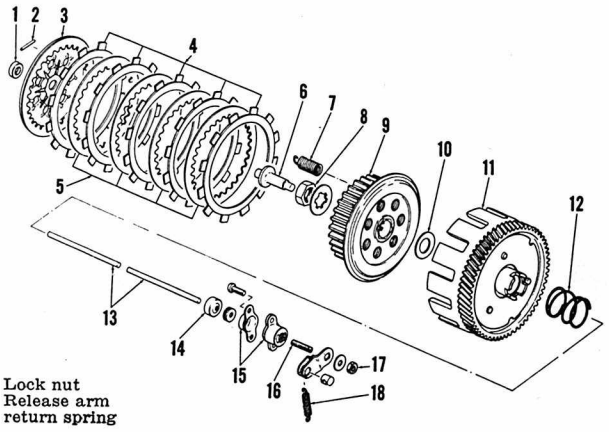


Fig. S14-10 — View of 125cc clutch assembly. Five steel plates (5) and six friction discs (4) are used in 185cc models.

1. Oil seal
2. Spring pin
3. Pressure plate
4. Friction discs
5. Steel plates
6. Pusher piece
7. Clutch spring
8. Hub retaining nut
9. Clutch hub
10. Thrust washer
11. Primary gear assembly
12. Spring
13. Push rods
14. Oil seal
15. Release screw assembly
16. Adjusting screw
17. Lock nut
18. Release arm return spring

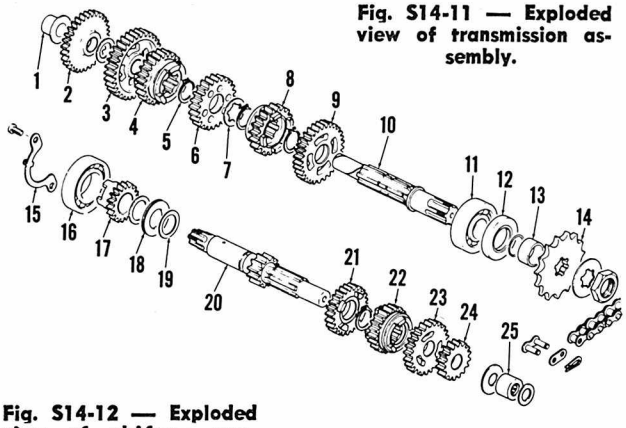


Fig. S14-11 — Exploded view of transmission assembly.

1. Drive shaft bushing
2. Kick idler gear
3. First driven gear
4. Fourth driven gear
5. Snap ring
6. Third driven gear
7. Gear washer
8. Fifth driven gear
9. Second driven gear
10. Drive shaft
11. Ball bearing
12. Oil seal
13. Sprocket spacer
14. Drive sprocket
15. Bearing retainer
16. Ball bearing
17. Kick driven gear
18. Bearing
19. Washer
20. Counter shaft
21. Fourth drive gear
22. Third drive gear
23. Fifth drive gear
24. Second drive gear
25. Needle bearing

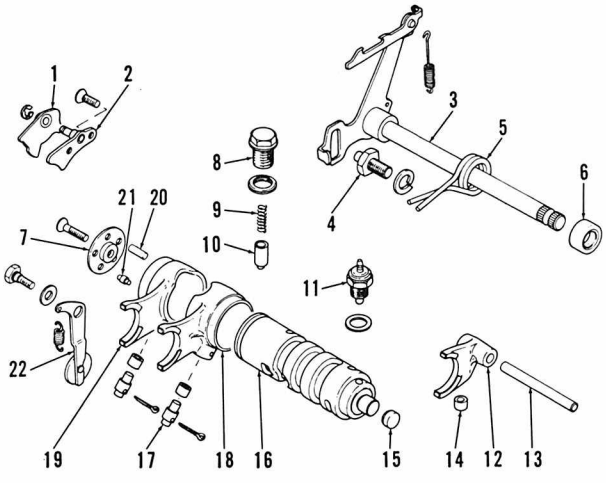


Fig. S14-12 — Exploded view of shifter components.

1. Cam stopper pawl
2. Cam guide
3. Shift shaft
4. Shift arm stopper
5. Return spring
6. Oil seal
7. Drive pin retainer
8. Stopper cap
9. Stopper spring
10. Shift cam stopper
11. Neutral switch
12. Shift fork
13. Shift fork shaft
14. Shift fork roller
15. Shift cam plug
16. Cam
17. Shift fork pin
18. High speed shift fork (Chrome)
19. Fourth gear shift fork
20. Shift cam drive pin
21. Shift cam stopper pin
22. Shift cam stopper assembly

two oversizes. If cylinder has been bored to an oversize, it is necessary to rechamfer edges of ports to prevent rings from hanging on the sharp edges and breaking. Torque cylinder head retaining nuts to 14.5-18 Ft.-Lbs. using a cross pattern to prevent head warpage.

CONNECTING ROD AND CRANKSHAFT. Engine must be removed from frame and crankcase halves separated to remove the crankshaft assembly. Maximum eccentricity of crankshaft when supported on "V" blocks and measured at ends of shaft is 0.0039 inch. Standard runout is 0.0023 inch or less. Maximum shake at small end of connecting rod is 0.118 inch. Crankshaft should only be disassembled if proper tools are available to correctly realign parts. Torque primary gear retaining nut to 32 Ft.-Lbs.

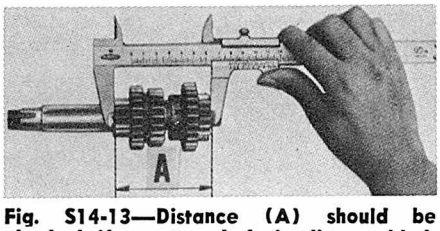


Fig. S14-13—Distance (A) should be checked if counter shaft is disassembled. Refer to text for proper length.

CLUTCH. The wet type multi disc unit is operated by a series of push rods passing through transmission counter shaft. Clutch may be disassembled without removing engine from frame. Remove right crankcase side cover and use a spring hook to aid in pulling spring pins (2—Fig. S14-10). Pressure plate (3) may then be removed to gain access to primary gear nut (8).

Standard free length of clutch springs (7) is 32 MM (1.25 inch) for 185cc models and 29.9 MM (1.17 inch) for 125cc models. Renew springs if more than 1 MM (0.04 inch) longer than standard. Standard thickness of friction disc (4) is 3.0 MM (0.118 inch) and discs should be renewed if less than 2.8 MM (0.110 inch). Steel plates (5) should be renewed if warped by more than 0.004 inch.

Reinstall springs (7) with ends flush with inboard side of hub (9). Position punch mark on pressure plate (3) so that it aligns with punch mark on clutch hub (9) when reassembling. Make certain that oil seal (1) is installed and in good condition.

CRANKCASE AND GEARBOX. The five speed constant mesh transmission (Fig. S14-11) may be disassembled after removing engine and separating the crankcase halves. Clutch, primary gear, external shifter parts (1, 2, 3, 5, and 7—Fig. S14-12) and kickstarter return spring must be removed from right side. Remove magneto base plate, output sprocket, oil pump and case holding screws in left side. Transmission and crankshaft should remain in right case half when separated.

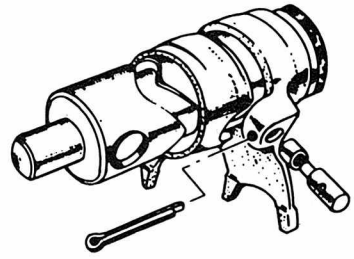


Fig. S14-14—Cotter pins must be installed with round end of head next to round side of shift fork or shifter will bind.

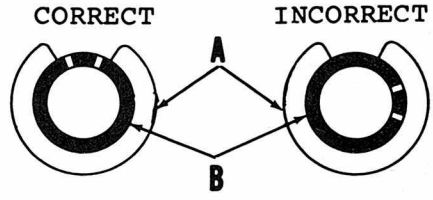


Fig. S14-15—Drive shaft bushing (1—Fig. S14-11) must be installed with holes toward top for proper lubrication of transmission.

Check transmission for broken or worn gears and burned shift forks.

Second drive gear (24—Fig. S14-11) is pressed onto countershaft (20). Gear cluster must be measured (Fig. S14-13) to make certain of correct fit in cases. Distance (A) should be 78.20 MM (3.079 inch).

Shift forks should have 0.008-0.016 inch side clearance in groove of sliding gears. Renew damaged parts if clearance exceeds 0.032 inch. Cotter pins must be installed in shift forks with round head of pin next to round side of shift fork (Fig. S14-14) and ends of cotter pins bent flat against flat side of fork. Incorrect installation will cause pin heads to bind in case.

Lubrication holes are drilled in drive shaft bushing (1—Fig. S14-11). Bushing must be installed with holes open at top (Fig. S14-15) to allow proper lubrication.

All bearings are shrink fitted in crankcase, therefore, it is necessary to heat case to remove or install bearings without damaging cases.

SPEED TUNING

A Hop Up Kit is available from Suzuki to improve performance of the 125cc TS 125 R. Basically the kit consists of a special carburetor, cylinder, cylinder head, piston

and expansion chamber. In most cases standard repair specifications may be used to maintain a TS 125 R with the speed kit installed. Any modification of standard parts or installation of performance parts will void any warranties. The following differences should be noted on kit modified units:

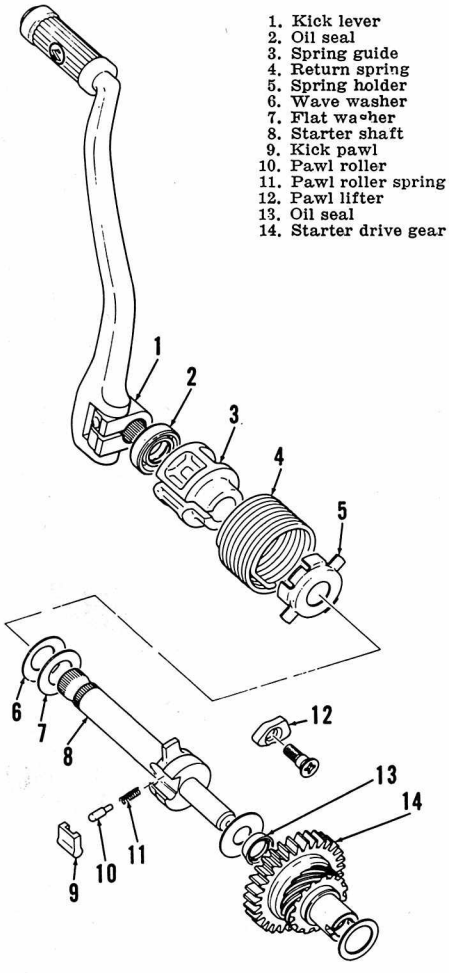


Fig. S14-16—Exploded view of kick starter assembly.

SPARK PLUG AND IGNTION. An NGK type B-8EN or equivalent is recommended. Spark plug should only be installed in left side hole in cylinder head. Right side hole is provided for installation of compression release only.

A PEI magneto is available. Unit is similar to the TM 400R magneto and is timed and checked in the same manner. Timing marks on rotor should align with mark on stator at 6000 RPM.

Lighting coil should be removed if standard magneto is used.

CARBURETOR. A Mikuni VM 26 SC sliding valve carburetor is used with the Hop Up Kit. The following specifications are used:

Main jet .....#180
Throttle valve 2.0
Jet needle .....5 DP 7
Pilot jet .....#35

Jet needle clip in third groove from top of needle.

Initial setting of pilot air screw should be one turn out from a lightly seated position.

A special shift cam stopper assembly (8, 9 & 10—Fig. S14-12) is furnished in the speed kit and must be installed to clear larger carburetor.

LUBRICATION. A 20:1 gas/oil mixture should be used in the fuel tank.

Oil pump must be left in place to provide proper lubrication for crankshaft main bearing but pump output is cut back. Disconnect oil pump control cable and use a piece of wire to hold pump open approximately 20 degrees (Fig. ST 14-1). Second punch mark on control arm should align with mark on pump stopper boss.

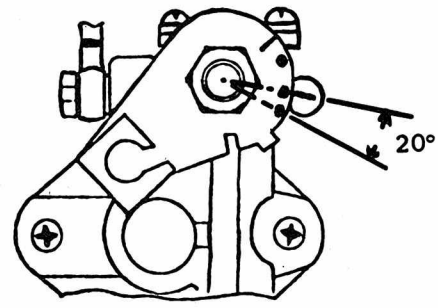


Fig. ST14-1—Oil pump should be secured in this position (approximately 20 degrees open) if mixed gas is used.

Pump output lines that route to cylinder and main bearing should be reversed. This will provide slightly more oil to main bearing and less oil to cylinder.

PISTON AND RINGS. The piston furnished with the speed kit has 1 MM (0.039 inch) shorter skirt than standard piston.

The TS 125 R Hop Up Kit piston will **not** accept the Keystone type piston rings that are used with standard piston. Flat rings are used in both grooves of kit piston.

CLUTCH. Spring pressure of the standard clutch may be increased by turning the clutch springs in one extra turn past flush with inboard side of clutch hub. This should provide approximately 0.5 MM clearance between clutch springs and primary gear assembly. Special parts are also available to increase capacity of clutch by two plates. This addition will allow normal installation of springs (flush with hub).

VESPA

MOTOR SCOOTERS

WESTERN SCOOTER DIST.
1599 Custer Ave.
San Francisco, CA 94124

MODEL	50	90	125	150	GL	GS
Frame number prefix	V5A1T	V9A1T	VNB1T, 2T, 3T, 4T & 5T	VBA1T, VBB1T & VBB2T	VLA1T	VSB1T
Engine number prefix	V5A1M	V9A1M	VNB1M, 2M, 3M, 4M & 5M	VBA1M, VBB1M & VBB2M	VLA1M	VSB1M
Displacement-cc	49	88	123	146	146	156
Bore-MM	38.25	47	52.5	57	57	58
Stroke-MM	43	51	57	57	57	60
Number of cylinders	1	1	1	1	1	1
Oil-fuel ratio	1 to 50	1 to 50	1 to 50	1 to 50	1 to 50	1 to 20
Plug gap-inch	0.024	0.024	0.024	0.024	0.024	0.024
Point gap-inch	0.011-0.019	0.011-0.019	0.011-0.019	0.011-0.019	0.011-0.019	0.011-0.019
Ignition timing-Advance	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
Degrees BTDC	28	28	28	28	28	28
Electrical system voltage	6	6	6	6	6	6
Tire size	2.75 X 9	3.00 X 10	3.50 X 8	3.50 X 8	3.50 X 10	3.50 X 10
Tire pressure psi-front	19	19	19	19	19	19
rear*	24	24	24	24	24	24
Number of speeds	3	3	4	4	4	4
Weight-lbs. (Approx.)	155	160	183	186	198	232

*Increase rear tire pressure to 28 psi when carrying passenger.

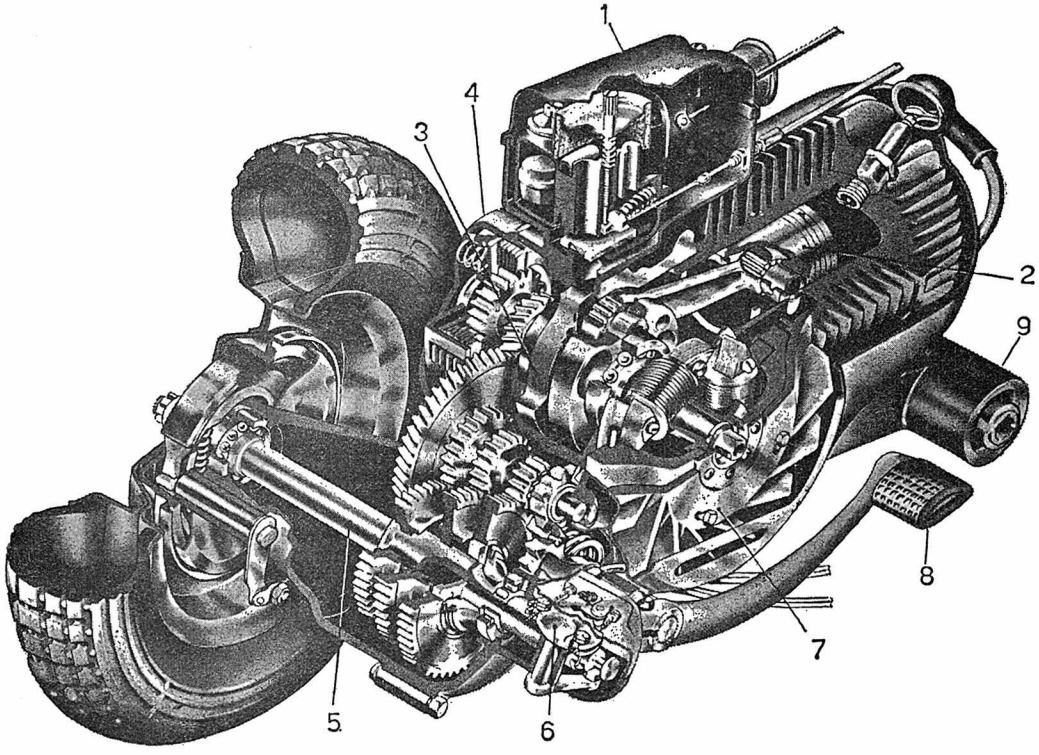


Fig. VE2-1—Sectional view power plant which has a rotary inlet valve integral with the crankshaft.

These scooters differ from the previous models in that the engine now incorporates a rotary type inlet valve. The valve is an integral portion of the crankshaft. A new immersed jet carburetor is placed directly over one of the crankshaft cheeks thus directing the fuel-air-oil mixture to the rod lower bearing. This arrangement coupled with the rotary valve permits use of a lower ratio of oil in the fuel and to improve the torque output characteristics.

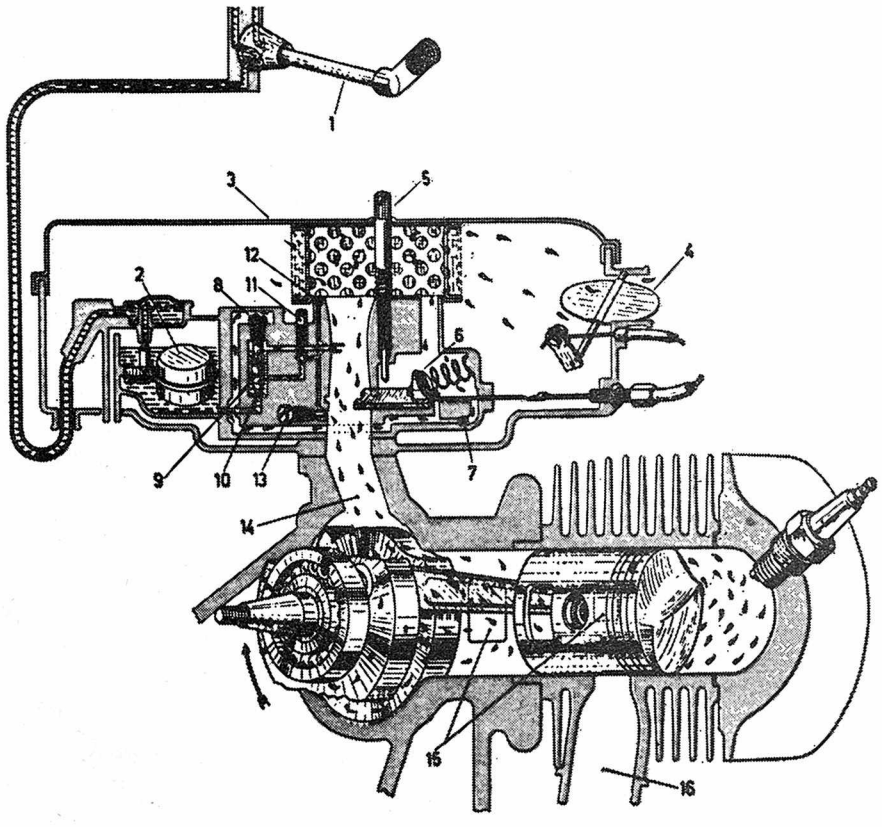


Fig. VE2-2—Fuel system and carburetor. Mixture is admitted directly over crankshaft. Note idle mixture adjustment (13) and non-adjustable main jet (10).

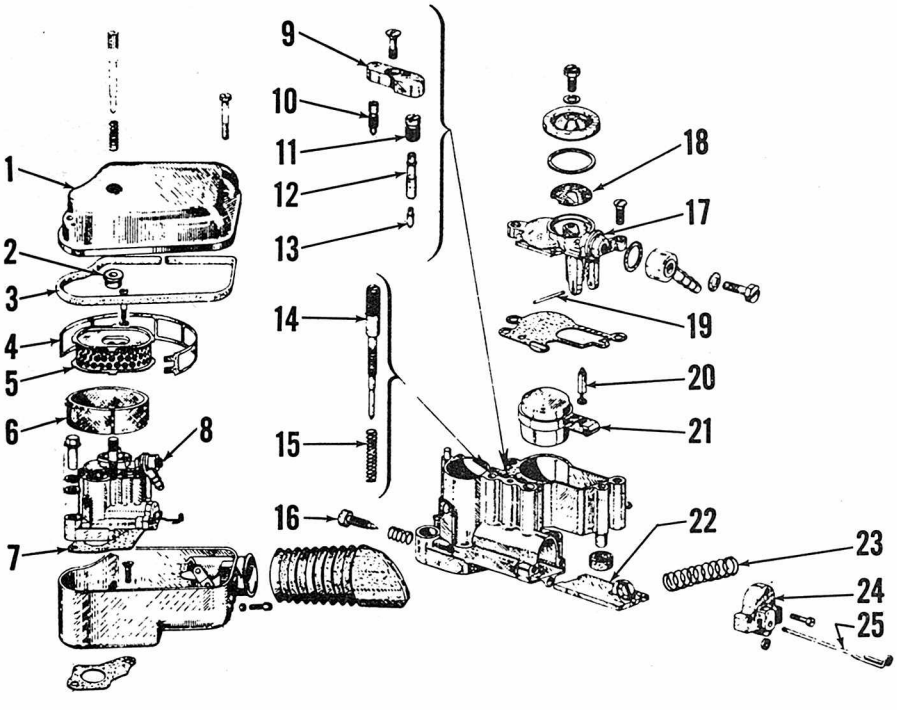


Fig. VE2-3—Carburetor and air cleaner typical of all models.

1. Cover
2. Seal
3. Seal
4. Clip
5. Filter
6. Channel
7. Gasket
8. Carburetor
9. Cover
10. Idle jet
11. Air jet
12. Atomizer
13. Main jet
14. Idle speed adjuster
15. Spring
16. Idle mixture adjusting screw
17. Cover
18. Filter
19. Float pivot
20. Inlet needle
21. Float
22. Throttle slide
23. Spring
24. Cover
25. Throttle rod

MAINTENANCE

SPARK PLUG. An Italian Marilli CW224JM or Champion L10 is used on all except 156 cc GS models. GS models use Marilli CW225JL or Champion N5. Spark plug electrode gap should be 0.024 in.

CARBURETOR. Idle mixture is adjusted by rotating the knurled screw (16—Fig. VE2-3). The high speed (power) range mixture is controlled by orfice size of the main jet (10). Float is vented inside the carburetor body.

IGNITION AND ELECTRICAL. Ignition and lighting is supplied by a flywheel type magneto alternator. The high tension ignition coil is mounted outside on the engine on all except 50 cc and 90 cc models. Lighting coils in the magneto provide 6 volt alternating current lighting system.

Breaker contact gap of 0.3-0.5 MM (0.011-0.019 in.) is adjusted through ports in flywheel by loosening screw (C—Fig. VE2-4) and rotating the cam (D). Ignition timing can be varied by shifting the stator plate position by means of screws (E). Recommended timing is 28 degrees before TDC.

LUBRICATION. The engine is lubricated by mixing SAE 30 two stroke engine oil with the fuel. Normal ratio is 1:50 for all except 156 cc models. Oil-fuel ratio for G. S. model should be 1:20. Gear box should be filled to level of filler opening with same type of oil as used in engine.

CLUTCH CONTROLS. The clutch control cable should be adjusted to provide 2 MM (0.078 in.) free play at hand lever as shown in Fig. VE2-5. Adjustment is at (A).

REPAIRS

Because of the close tolerance of the interior parts, cleanliness is of utmost importance. It is suggested that the exterior of the engine, gear box and all nearby areas be absolutely clean before any repair is started.

Engine should be removed from chassis for easy performance of most internal repair work.

PISTON, RINGS AND CYLINDER. Access to piston is obtained by removing the cowling, cylinder head and cylinder from the crankcase.

Ring end gap new should be 0.2-0.35 MM (0.008-0.014 inch) with reject at anything greater than 2.0 MM (0.078 inch). Pistons and rings are furnished in oversizes of 0.2, 0.4, 0.6 and 0.8 MM which is the equivalent of 0.008, 0.015, 0.023 and 0.031 inch respectively.

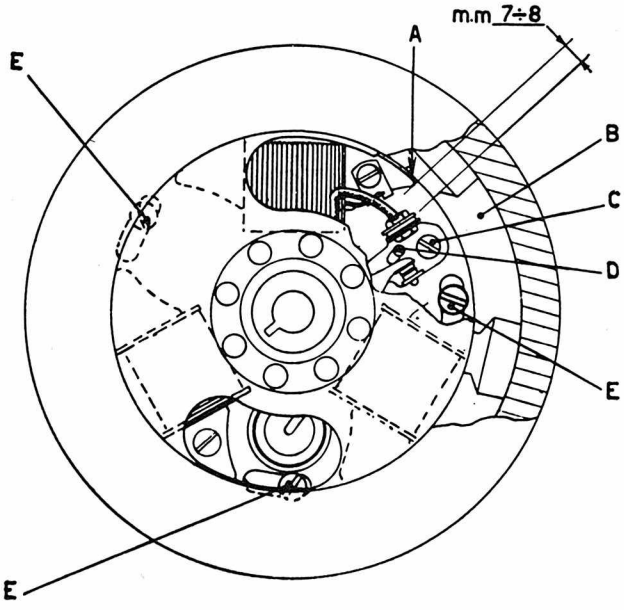


Fig. VE2-4 — Inspection port in flywheel (rotor) permits access to screw (C) to adjust breaker contacts and time the ignition.

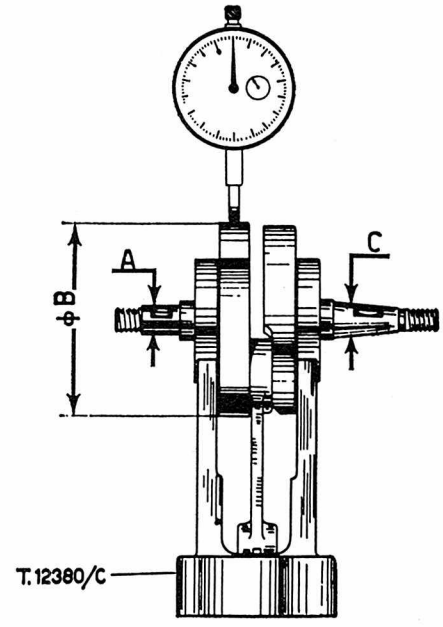


Fig. VE2-7—Crankshaft and connecting rod assembly is mounted in special fixture to check eccentricity.

Piston pin is retained in the unbushed piston by snap rings and rides in a caged needle roller bearing in the upper end of the connecting rod. Renew needle bearing if any rollers are pitted or show flat spots. Pin should have zero clearance in piston with reject of piston and/or pin when clearance exceed .02 MM or 0.0007 in. Pins are available only in standard size.

Piston skirt clearance should be 0.002 in. for all except 160 cc GS models which is 0.004 in. Piston and cylinder nominal standard sizes in inches are as follows:

MODEL	Piston	Cylinder	Clearance
50 cc	1.510	1.512	0.002 in.
90 cc	1.848	1.850	0.002 in.
125 cc	2.064	2.066	0.002 in.
150 cc	2.241	2.243	0.002 in.
160 cc	2.279	2.283	0.004 in.

CONNECTING ROD AND CRANKSHAFT. The built up crankshaft and connecting rod assembly should not be disassembled except in Vespa repair depots equipped with the special facilities required. The assembly can be removed after first separating the crankcase halves.

Ball type main bearings can be renewed without disassembling the crankshaft assembly. If bearings remain in case halves when case is separated they usually can be lifted by heating the case halves. If bearings adhere to shaft journals a puller will be required to remove them.

Installation of new or original main bearings to crankshaft journals is facilitated by immersing them in hot oil (212°F.) for about 6 minutes just prior to installation.

When reinstalling the crankshaft assembly to the crankcase refer to CRANKCASE AND REASSEMBLY.

GEAR BOX. The relationship of gear box parts to each other is shown in Fig. VE2-1. The procedure for removing these parts is evident after the crankcase halves have been separated.

The mainshaft and pinions assembly can be disassembled by extracting the snap ring from the outer face of outer gear. Refer to Fig. VE2-8. End play of gears (A) on mainshaft should be within the limits 0.15-0.30 MM (0.006-0.012 inch) new. If end play exceeds 0.50 MM (0.020 inch) install a thicker shoulder ring (B) to reduce amount of end play. Shoulder rings are available in 4 oversizes.

The ball bearings which support the lay shaft and the mainshaft can be inspected and if necessary renewed, while these shafts are out of the crankcase.

When reassembling these parts refer to CRANKCASE AND REASSEMBLY.

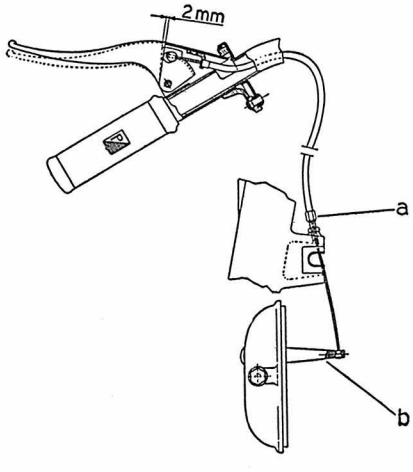


Fig. VE2-5—Clutch control on handlebars should have 2 MM (0.078 in.) free travel before moving lever (b).

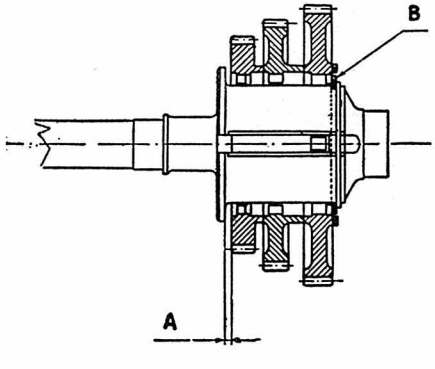


Fig. VE2-8—If end play of mainshaft gears measured at (A) exceeds 0.50mm (0.020 inch) install a thicker shoulder ring (B).

CRANKCASE AND REASSEMBLY. When reassembling the various subassemblies to the crankcase observe these instructions:

Install first the mainshaft ball bearing then the cush gear and layshaft.

When installing cush (cushion) gear and layshaft, grease the roller track on the layshaft to hold the rollers in place. Slide the cush gear in from lower portion of case, bump the layshaft through cush gear, then temporarily install nut on opposite end of layshaft.

When assembling the three pinions to the mainshaft and crankcase, the second and third gear pinions should be assembled with their collars turned outward; first gear pinion (largest diameter) with collar having the more pronounced relief toward the clutch side of crankcase.

Install into the same side of crankcase the circlip used to locate the crankshaft oil seal. Make sure lug on circlip fits into crankcase slot. Assemble mainshaft roller bearing to opposite half-crankcase.

Assemble clutch side crankshaft seal after first heating the bearing seating (inserted bushing or liner) to approximately 176°F. Assemble flywheel side crankshaft seal with suitable piloted drift, being sure that slotted portion of seal registers with the oil hole in crankcase. While clutch side of crankcase is still warm assemble the crankshaft and rod assembly into clutch side crankcase. Assemble the kick starter.

Clean the joining faces of both crankcase halves. Using an electric hot plate or other means, heat the main bearing seating in the flywheel side crankcase. Fit a pilot sleeve or tape over crankshaft keyway splines and tapered wedge between the circular webs of the crankshaft and connecting rod assembly. Coat the joining faces of the crankcase halves with shellac and fit the paper gasket. Join the two halves while engaging the kick starter gear sector with the starter pinion. Tap only on the flywheel side of case with wooden mallet until joined, then bolt the halves together.

Before completing the reassembly make sure that crankshaft rotates freely.

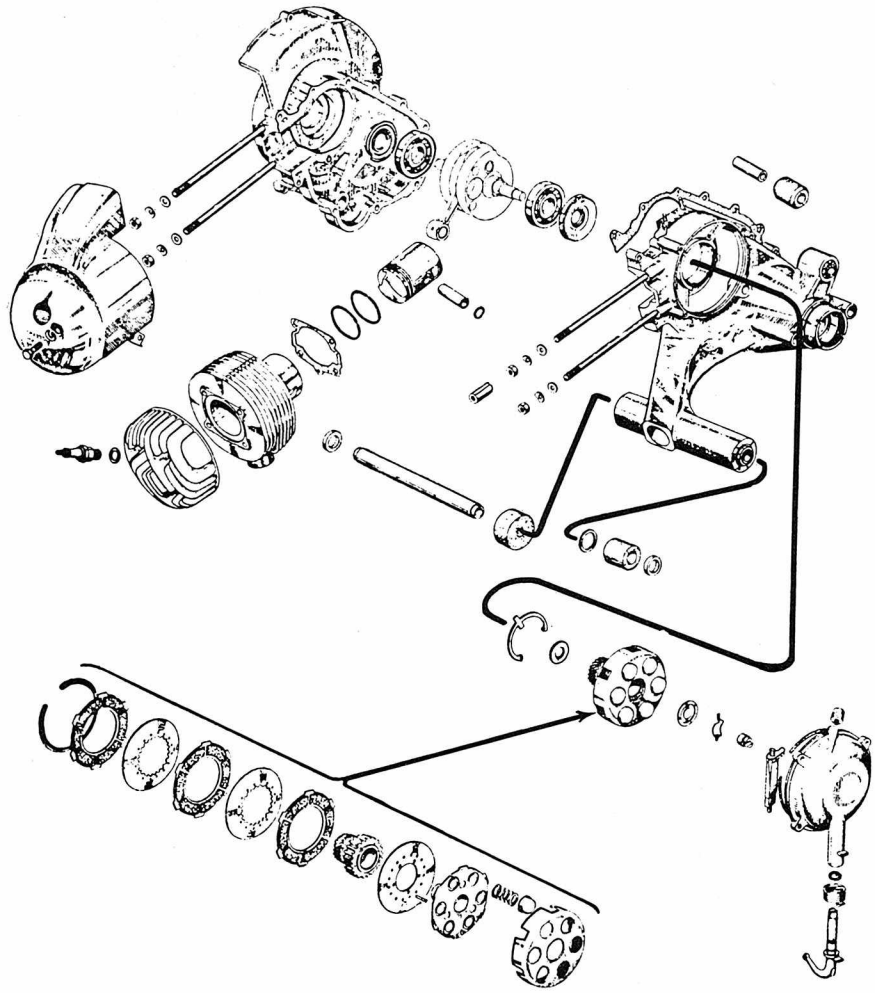


Fig. VE2-9—Exploded view of engine and clutch assembly.

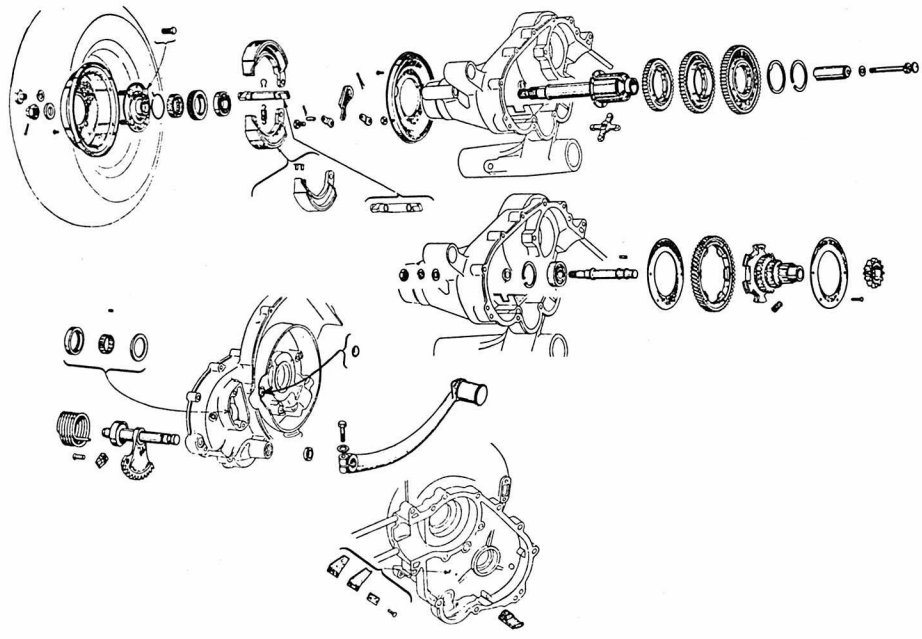


Fig. VE2-10—Exploded view of three speed transmission. Four speed models are similar.

VILLIERS

VILLIERS ENGINES

MODEL	No. Cyls.	Bore	Stroke	Displ.
3K	1	40 MM 1.57 in.	39.7 MM 1.56 in.	50 cc 3.05 cu in.
4F, 6F & 9F	1	47 MM 1.85 in.	57 MM 2.24 in.	98 cc 6.0 cu. in.
31C	1	57 MM 2.24 in.	58 MM 2.28 in.	148 cc 9.03 cu. in.
2L & 3L	1	59 MM 2.32 in.	63.5 MM 2.5 in.	173 cc 10.55 cu. in.
9E	1	59 MM 2.32 in.	72 MM 2.83 in.	197 cc 12.03 cu. in.
Class A*	1	66 MM 2.6 in.	72 MM 2.83 in.	246 cc 15.0 cu. in.
2T & 4T	2	50 MM 1.97 in.	63.5 MM 2.5 in.	250 cc 15.2 cu. in.
3T	2	57 MM 2.24 in.	63.5 MM 2.5 in.	324 cc 19.76 cu. in.

*Class A engines include Mark 31A, 32A, 34A, 35A and 36A.

These Villiers engines are used in many vehicles including some models of Ambassador, Cotton, D.M.W., Dot, Excelsior, Francis-Barnett, Greeves, Norman, Panther and Royal Enfield motorcycles.

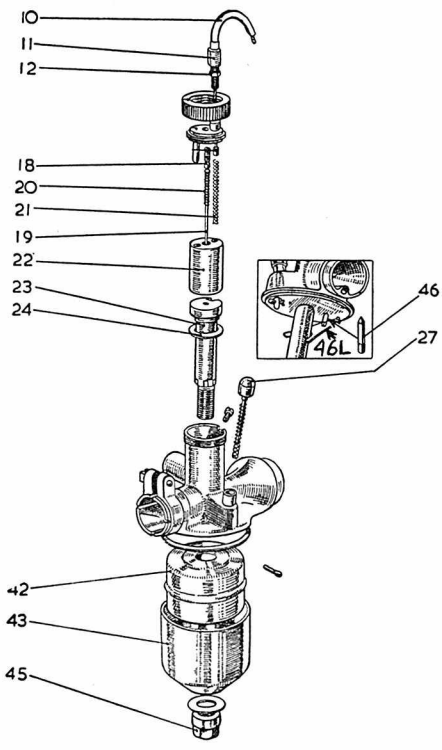


Fig. V1—Exploded view of Villiers Junior carburetor.

10. Control cable
11. Cable adjuster
12. Locknut
18. Screw
19. Needle
20. Spring
21. Spring
22. Throttle slide
23. Jet body
24. Fiber washer
27. Tickler
42. Float
43. Float bowl
45. Nut
46. Fuel needle
46L. Needle lever

MAINTENANCE

SPARK PLUG. Recommended spark plugs are as follows: For model 3K use Lodge BN14; for models 4F and 6F use Lodge H14; for model 9F use Lodge 3HN; for models 34A and 36A use Lodge RL47 or RL49; for all other models use Lodge HH14. Electrode gap for all models is 0.018-0.025 inch.

CARBURETOR. Carburetor application is as follows:

Engine Model	Villiers Carburetor Model
3K	S. M. 10
4F and 6F	Junior 6/0 or S.12
9F and 31C	S.19
2L, 3L, 2T and 3T	S.22
31A, 32A, 35A, 9E and 4T	S.25

Refer to appropriate following paragraph for service information.

VILLIERS JUNIOR CARBURETOR. Fig. V1 shows exploded view of Villiers Junior carburetor. Low idle speed is adjusted by turning collar (11) and and adjustment is locked by jam nut (12). The high speed mixture is adjusted by turning screw (18). With fuel inlet needle lever (46L) correctly shaped and installed, distance between top of float and carburetor body should be 7/32-inch with fuel inlet needle valve (46) seated.

VILLIERS S.12 CARBURETOR. Fig. V2 shows exploded view of Villiers S.12 carburetor. Low idle speed is adjusted by turning collar (44) and adjustment is locked by turning jam nut (3). Main jet needle (43) is provided with 5 grooves at upper end as shown in the inset. Clip (5) is positioned in one of these grooves. Installation of clip in a higher groove will lean the high speed mixture. Normally clip should be in the middle (Number 3) groove. With fuel inlet needle lever (17) correctly shaped and installed, distance between top of float and carburetor body should be 7/32-inch with the fuel inlet needle valve (15) seated.

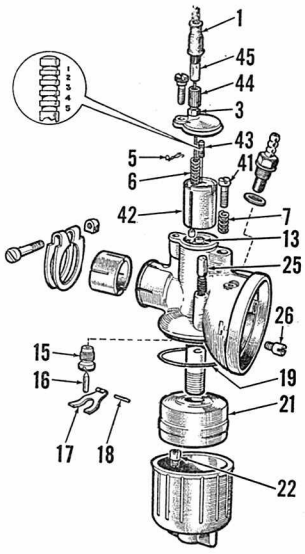


Fig. V2 — Exploded view of Villiers S.12 carburetor.

1. Cable cover
3. Nut
5. Clip
6. Spring
7. Spring
13. Needle jet
15. Inlet valve seat
16. Needle valve
17. Needle lever
18. Pin
19. Gasket
21. Float
22. Main jet
25. Tickler
26. Air jet
41. Air screw
42. Throttle slide
43. Needle
44. Cable adjuster
45. Throttle cable

VILLIERS S.19 AND S.25 CARBURETORS. Fig. V3 shows exploded view of Villiers S.19 and S.25 carburetors. Low idle speed is adjusted by turning collar (3) and adjustment is locked by turning jam nut (4). The high speed mixture is adjusted by turning screw (9). Turning screw (9) in a clockwise direction will lean the mixture. Low speed mixture is adjusted by turning needle (27). Clockwise rotation of needle (27) will richen the mixture. Throttle slide (14) is made with a cut-away on the inlet side. Throttles are marked with a number which represents (in sixteenths of an inch) the amount of cutaway. A throttle with more cutaway will give leaner mixtures. If acceleration is slow, install throttle slide with smaller cut-away. If engine runs too rich when idling, install throttle slide with larger cut-away.

VILLIERS S.22 CARBURETOR. Fig. V5 shows exploded view of Villiers S.22 carburetor. Low idle speed is adjusted by turning collar (2) and adjustment is locked by turning jam nut (3). Main jet needle (29) is provided with 5 grooves at its upper end as shown in the inset. Clip (32) is positioned in one of these grooves. Installation of clip in a higher groove leans the high speed mixture. Low speed mixture is adjusted by turning needle (22). Clockwise rotation of the needle will richen the mixture. Throttle slide (30) is made with a cut-away on the inlet side. Throttle slides are marked with a number which represents (in sixteenths of an inch) the amount of cut-away. A throttle with more cut-away will give leaner mixtures. If acceleration is slow, install throttle slide with smaller cut-away. If engine runs too rich when idling, install a throttle slide with larger cut-away. With fuel inlet needle lever (13) correctly shaped and installed, distance between top of float and gasket surface of carburetor body should be ¼-inch as shown in inset in Fig. V5.

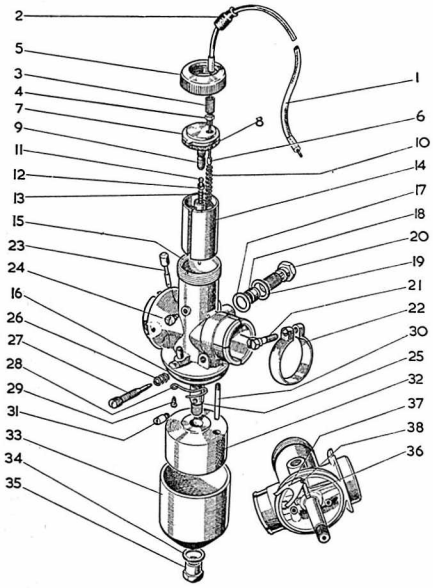


Fig. V3—Exploded view of Villiers S.19 and S.25 carburetors.

1. Throttle cable
3. Cable adjuster
4. Locknut
8. Fiber washer
9. Screw
10. Spring
11. Needle
12. Needle collar
13. Spring
14. Throttle slide
23. Tickler
25. Centerpiece
26. Spring
27. Pilot jet needle
28. Spring
29. Screw
30. Pilot jet
31. Main jet
32. Float
36. Fuel needle valve
37. Needle lever
38. Pin

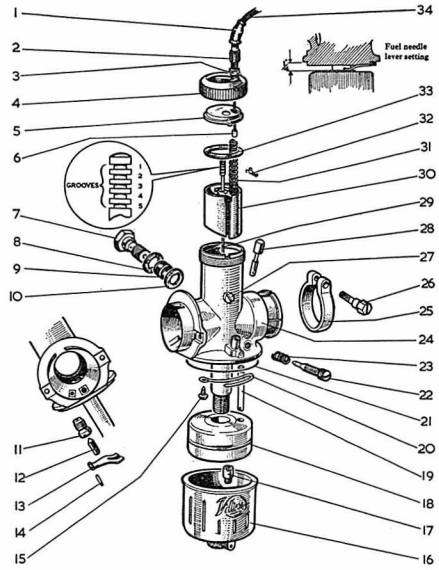


Fig. V5 — Exploded view of Villiers S.22 carburetor.

2. Cable adjuster
3. Nut
11. Needle valve seat
12. Needle valve
13. Needle lever
14. Pin
15. Screw
17. Main jet
18. Float
19. Pilot jet
20. Spring
21. Gasket
22. Pilot jet needle
23. Spring
27. Guide screw
28. Tickler
29. Needle
30. Throttle slide
31. Spring
32. Clip
33. Washer
34. Throttle cable

VILLIERS S. M. 10 CARBURETOR. Fig. V6 shows exploded view of Villiers S. M. 10 carburetor. Low idle speed is adjusted by turning cable adjuster (2) and locked by tightening the jam nut. Intermediate mixture is adjustable by moving clip (6) up or down in grooves of valve needle (7). Installation of clip in higher grooves leans mixture.

IGNITION AND ELECTRICAL. Various types of electrical systems are used. Basic, most used, systems are described as follows.

MARK 3K. Ignition point gap should be 0.012-0.015 in. and is adjusted through holes in flywheel at

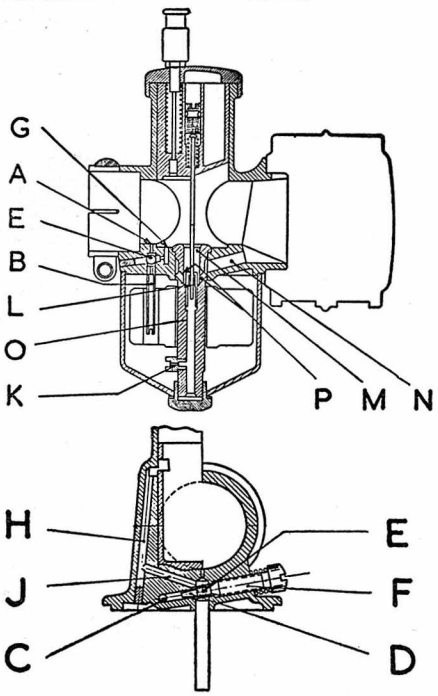


Fig. V4—Cross-section drawing of Villiers S.19 and S.25 carburetors.

A. Pilot outlet hole
B. Pilot tube
C. Passage
D. Variable air-jet
E. Pre-mix chamber
F. Pilot adjusting screw
G. Pilot "progression"
H. Passage
J. Passage
K. Main jet
L. Needle jet
M. Pre-mixing chamber
N. Passage
O. Center piece
P. Small holes (4)

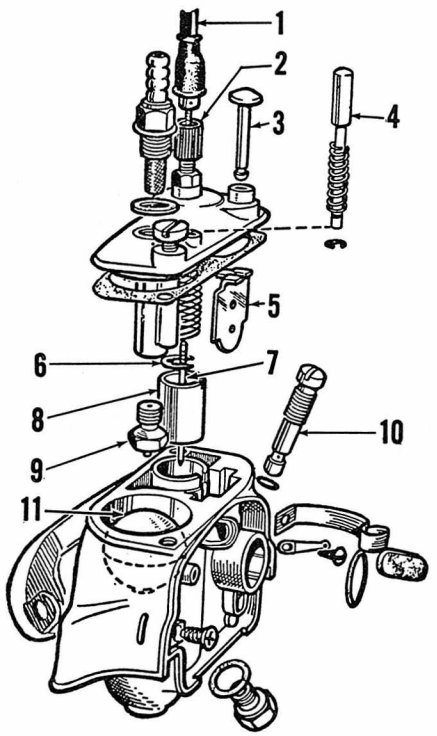


Fig. V6—Exploded view of Villiers SM.10 carburetor used on 3K engines.

1. Throttle cable
2. Adjuster
3. Choke control
4. Tickler
5. Choke slide
6. Clip
7. Valve needle
8. Throttle slide
9. Inlet valve
10. Main jet
11. Float

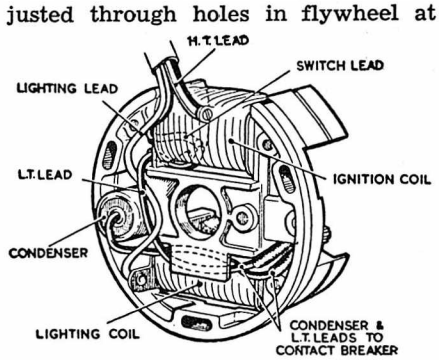


Fig. V7—View of 3K magneto stator and coils.

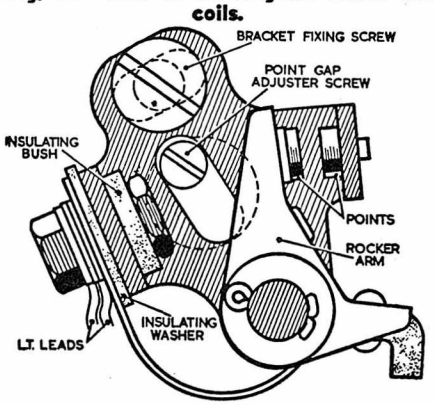


Fig. V8—View of 3K ignition breaker point assembly.

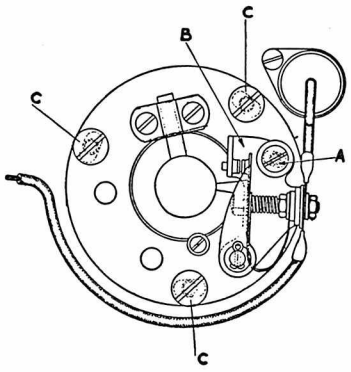


Fig. V11—View of models 4F, 6F and 9F breaker point assembly.

A. Point gap adjusting screw
B. Breaker point assembly
C. Timing adjustment screws

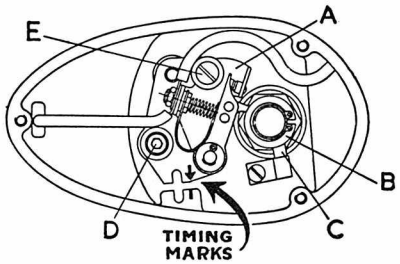


Fig. V15—View of breaker point installation on models 2L, 9E and 31C.

A. Breaker point assembly
B. Cam
C. Felt cam wiper
D. Timing adjustment screw
E. Point gap adjustment screw

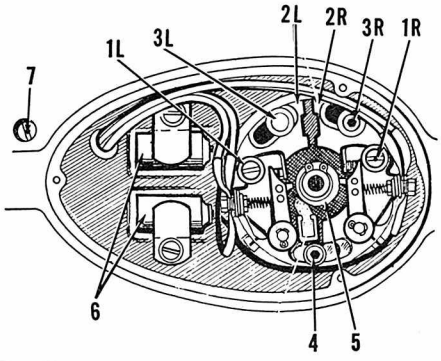


Fig. V16—View of Mark 2T and 3T right side showing ignition timing points.

1. Point gap screws
2. Base plates
3. Base plate screws
4. Base plate screw
5. Cam
6. Condensers
7. Clutch adjusting screw

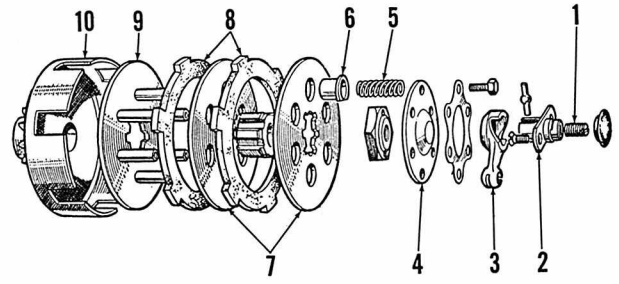
screws shown in Fig. V8. Ignition should occur (points just open) when piston is 3/32 in. BTDC. Stator plate (Fig. V7) can be moved in the elongated mounting holes after loosening the three mounting screws.

MARK 4F, 6F and 9F. A six pole, six volt flywheel type magneto is used. Either rectifier or direct lighting is available.

Breaker point assembly is located on left side of engine and is accessible after removing the left cover. Refer to Fig. V11. Breaker points should have 0.012-0.015 in. gap. Air gap between coil laminations and flywheel magneto should be 0.012-0.015 in.

Fig. V18—Exploded view of Mark 3K clutch assembly.

1. Adjusting screw
2. Bracket
3. Lever
4. Cover
5. Spring (6 used)
6. Spring cup (6 used)
7. Driving plates
8. Friction discs
9. Pressure plate
10. Clutch drum and sprocket



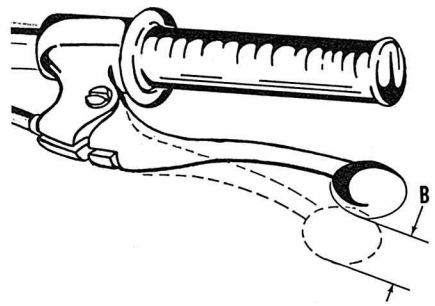


Fig. V19—Clutch cable should be adjusted to provide free play at B. Refer to text.

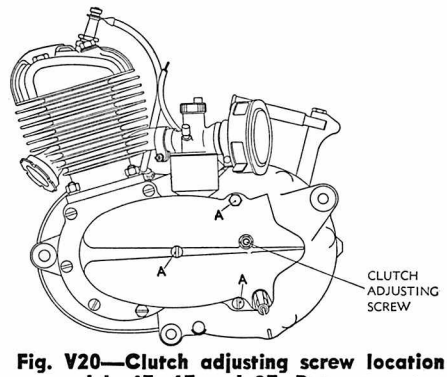


Fig. V20—Clutch adjusting screw location on models 4F, 6F and 9F. Remove screws marked "A" for access to breaker points.

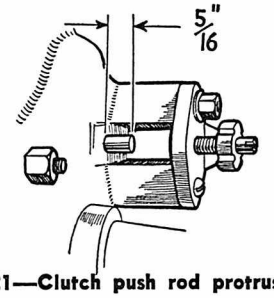


Fig. V21—Clutch push rod protrusion.

To set timing, first check and reset breaker point gap. Position piston ⅛-inch BTDC. Loosen screws (C—Fig. V11) attaching breaker point adapter plate to left half of crankcase and shift plate until points just begin to open. Retighten adapter plate mounting screws. Shifting plate in clockwise direction retards timing.

MARK 2L, 3L, 9E, 31C and CLASS A. Some engines are equipped with a 6-volt electrical system with either rectifier or direct lighting. Other engines use 12-volt electrical systems with rectifier lighting. Six volt systems use two lighting coils and one spark coil.

Breaker point assembly is located on left side of engine and is accessible after removing the left side cover. Refer to Fig. V15. Breaker point gap should be 0.012-0.015 inch. Air gap between coil laminations and flywheel should also be 0.012-0.015 inch.

To check timing, first check and reset breaker point gap. Position piston 5/32-3/16 inch BTDC for all models except 34A and 36A; 1/8-5/32 inch BTDC for 34A and 36A. Breaker points should be just starting to open with piston in this position. If timing is incorrect, remove solder from Allen head screw (D—Fig. V15) and after loosening screw, shift breaker base to obtain correct timing.

MARK 2T, 3T and 4T. Two separate ignition assemblies are used and must be adjusted individually for each cylinder. Ignition point gap should be 0.012-0.015 in. The ignition points, base plate (2L—Fig. V16) and top condenser are for the left hand (drive side) cylinder. To reset timing, set point gap and then position left hand piston at 3/16 inch BTDC (or 26 degrees BTDC). Loosen base plate screws (4 & 3L) and move base plate (2L) until points just open. The right hand cylinder is similarly timed. After both cylinders have been set, recheck to make certain that both cylinders are timed exactly the same.

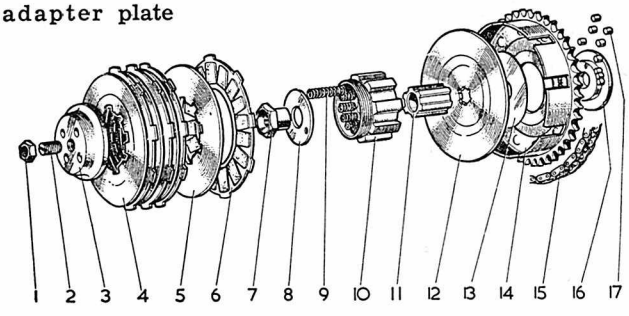


Fig. V22—Exploded view of clutch used on Mark 2L, 9E, 31C, 31A, 32A, 33A, 34A, 2T and 3T.

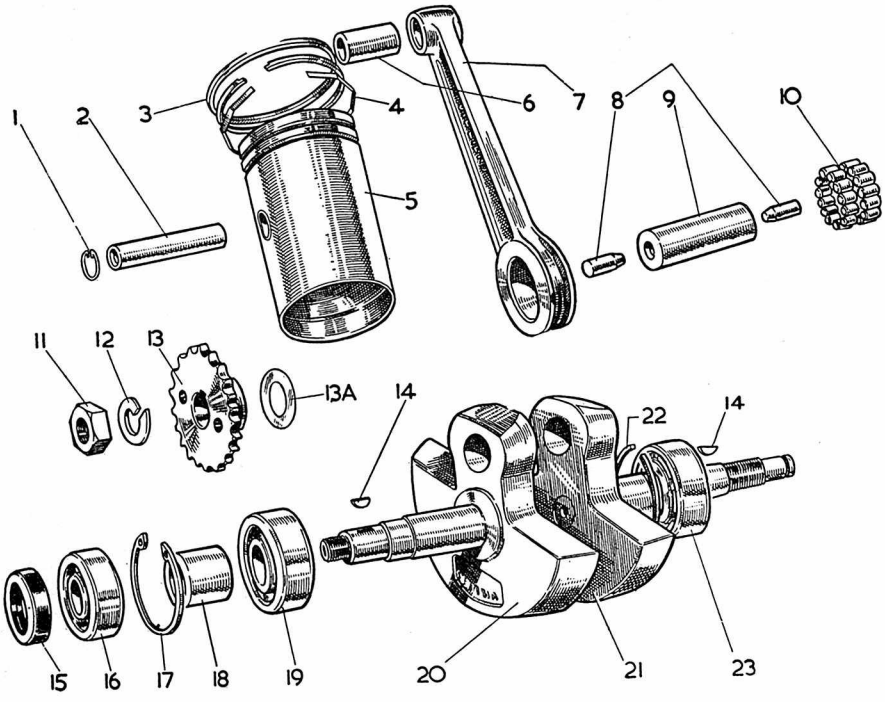


Fig. V23—Exploded view of crankshaft, rod and piston assemblies on Mark 2L, 9E, 31C, 31A, 32A, 33A and 34A.

1. Retaining rings (2)
2. Piston pin
3. Piston rings
4. Bottom ring expander
5. Piston
6. Connecting rod bushing
7. Connecting rod
8. Crankpin plugs (2)
9. Crankpin
10. Needle bearings
11. Nut
12. Lockwasher
13. Chain sprocket
14. Woodruff key
15. Seal
16. Ball bearing
17. Snap ring
18. Spacer
19. Ball bearing
20. Counterweight and main shaft
21. Counterweight and main shaft
22. Snap rings
23. Ball bearing

LUBRICATION. The engine is lubricated by mixing SAE 30 two stroke engine oil with the fuel. Normal ratio is 1:20. Competition models 34A and 36A should use Castrol "R" with 1:24 oil-fuel ratio. The gear case on Mark 4F, 6F and 9F should be filled with SAE 140 gear oil. On other models, gear case uses SAE 30 and chain case SAE 20 engine oil.

CLUTCH. Refer to the following paragraphs for clutch adjustment procedures.

MARK 3K. Loosen the cable and remove plug from right side cover. Turn adjusting screw (1—Fig. V18) until clutch is disengaged, then back screw out ¼-½ turn. Clutch should

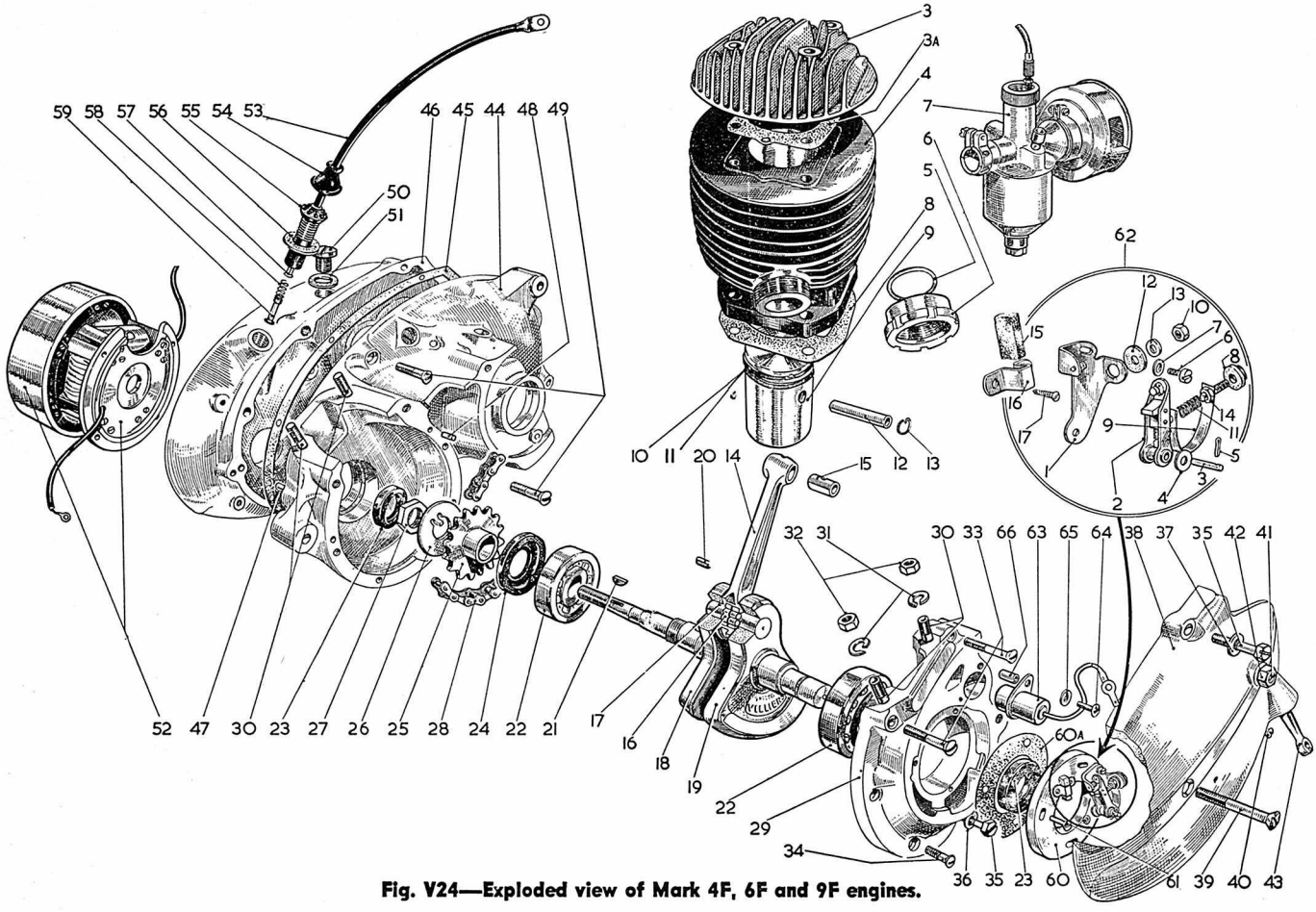


Fig. V24—Exploded view of Mark 4F, 6F and 9F engines.

3. Cylinder head
3A. Head gasket
4. Cylinder
5. Seal
6. Exhaust nut
7. Carburetor
8. Cylinder gasket
9. Piston
10. Piston rings
11. Lower ring expander
12. Piston pin
13. Snap rings (2)
14. Connecting rod
15. Bushing
16. Needle bearings
17. Crankpin
18. Counterweight and main shaft
19. Counterweight and main shaft
21. Woodruff key
22. Ball bearings
23. Seal
24. Seal
25. Sprocket
28. Drive chain
29. Crankcase cover
38. Cover
41. Clutch adjusting screw
43. Clutch lever
44. Crankcase
45. Gasket
46. Cover
50. Filler plug
52. Magneto
53. High tension wire
60. Breaker plate
62. Breaker points (Inset)
1. Contact base
2. Contact arm
3. Pivot pin
9. Arm spring
11. Spring
15. Cam wiper felt
63. Condensor

be engaged (should not slip). The clutch cable adjuster should be adjusted to provide 1/16-3/16 inch free play at B—Fig. V19.

MARK 4F, 6F and 9F. The clutch lever should be adjusted as follows: Loosen locknut and turn adjusting screw (Fig. V20) as required until 1/16 to ⅛ inch clearance between lever and cover is obtained. If clutch lever touches cover, rapid clutch wear will result. Clutch cable should be adjusted to provide ⅛ inch free play at B—Fig. V19.

MARK 2L, 3L, 9E, 31C, 2T, 3T, 4T and CLASS A. Adjust clutch as follows:

Loosen the clutch control cable to obtain some slack and remove the clutch lever (13—Fig. V26 or 82—Fig. V27). Check clutch push rod protrusion (Fig. V21) which should be 5/16-inch. If protrusion is not correct, turn adjusting screw (2—Fig. V22) as required to obtain correct protrusion and lock by tightening jam nut (1). Reinstall lever (13—Fig. V26 or 82—Fig. V27) making certain ⅛-inch clearance is present between end of push rod (28—Fig. V26 or 36—Fig. V27) and clutch lever. If clearance is incorrect, turn adjusting screw (14—Fig. V26 or 81—Fig. V27). After the preceding adjustments are accomplished, tighten the clutch control cable to provide ⅛ inch free play at B—Fig. V19.

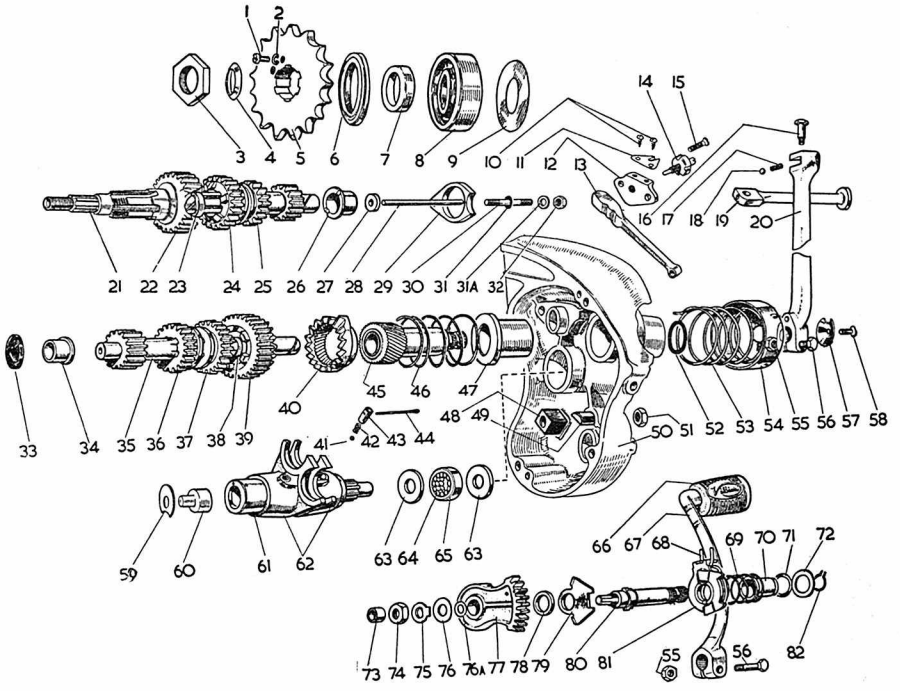


Fig. V26—Exploded view typical of four speed transmission used on Mark 2L, 9E, 31C, 31A, 32A, 33A and 34A.

REPAIRS

PISTON, RINGS AND CYLINDER. The two piston rings are identical with stepped ends and are pinned to the piston. The lower ring is equipped with an expander to prevent piston noise while engine is cold. Pistons and rings are available in standard size and 0.015 and 0.030-inch oversize. Piston and ring clearance data is as follows: (All dimensions are in inches.)

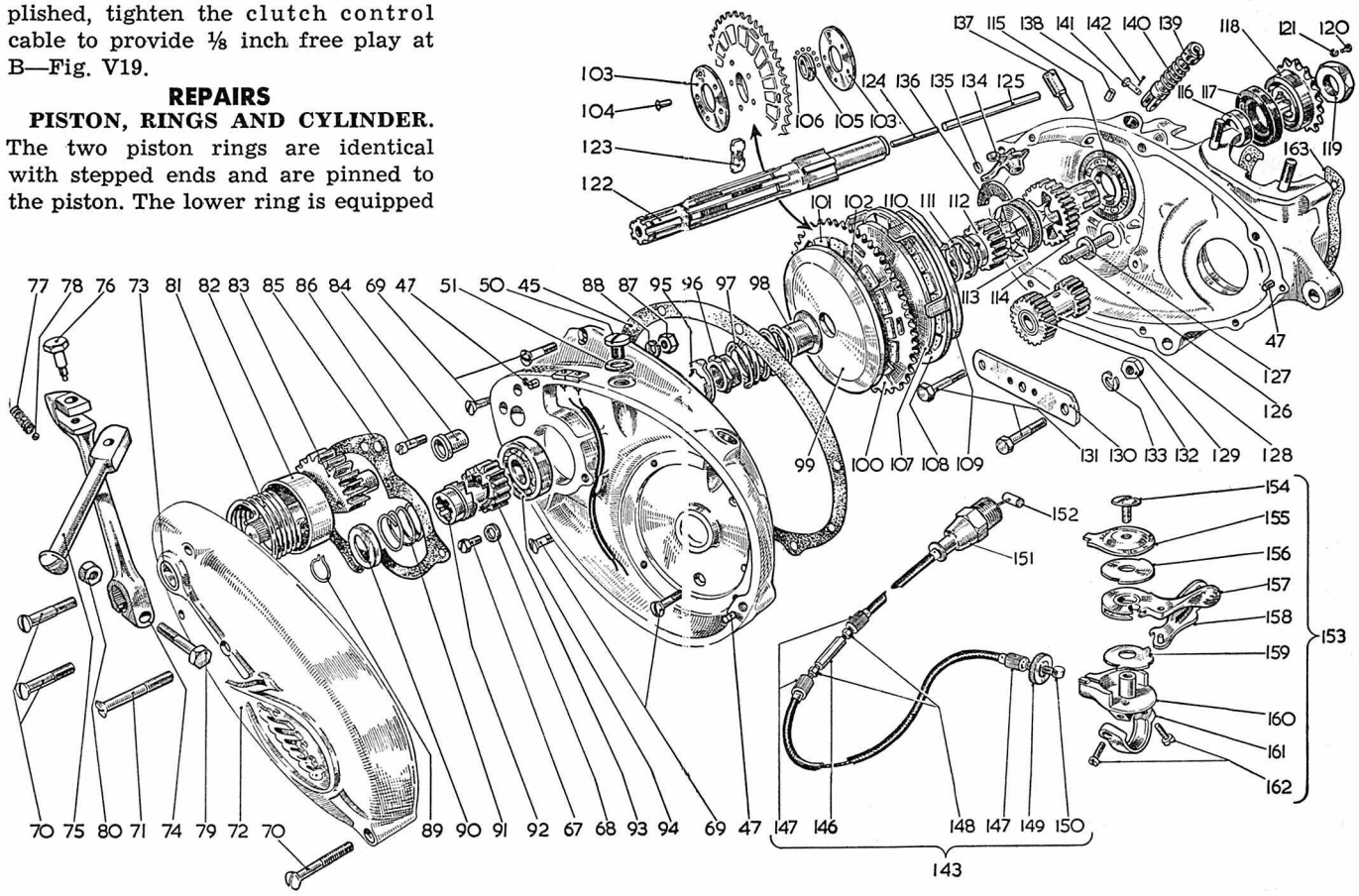


Fig. V25—Exploded view of clutch and transmission used on Mark 4F, 6F and 9F.

Ring end gap
Mark 3K .....0.006-0.010 in.
wear limit .....0.025 in.
Mark 4F, 6F, 9F,
2T & 4T .....0.007-0.011 in.
wear limit .....0.030 in.

All other models
new .....0.008-0.012 in.
wear limit .....0.030 in.

Piston skirt to cylinder clearance
Mark 4F, 6F—
Minimum .....0.0038 in.
Maximum .....0.0048 in.
Mark 9F, 2T—
Minimum .....0.0048 in.
Maximum .....0.0058 in.
Mark 2L, 9E, Class A—
Minimum .....0.0048 in.
Mark 31C, 3T, 3L—
Minimum .....0.0041 in.
Mark 4T—
Minimum .....0.0027 in.
Maximum .....0.0034 in.

Piston pin should be a push fit in connecting rod and piston. Piston has non-renewable bushings for pin; bushing in pin end of connecting rod is renewable.

Side of piston head marked "Front" should be installed to front of engine.

If cylinder is scored or worn 0.008 inch, it should be rebored to next larger oversize of 0.015 or 0.030 inch, or be renewed. Standard bore diameters are as follows:

Nominal Cylinder Bore	Standard Bore Size
40 MM	1.574-1.575 in.
47 MM	1.8499-1.8504 in.
50 MM	1.9678-1.9688 in.
57 MM	2.2445-2.2450 in.
59 MM	2.3235-2.3240 in.
66 MM	2.598-2.600 in.

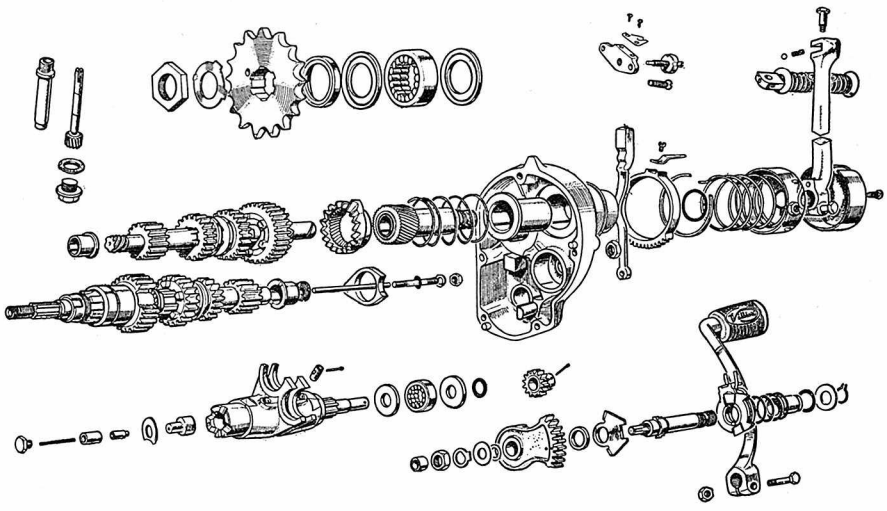


Fig. V28—Exploded view of four speed transmission used on 2T and 3T.

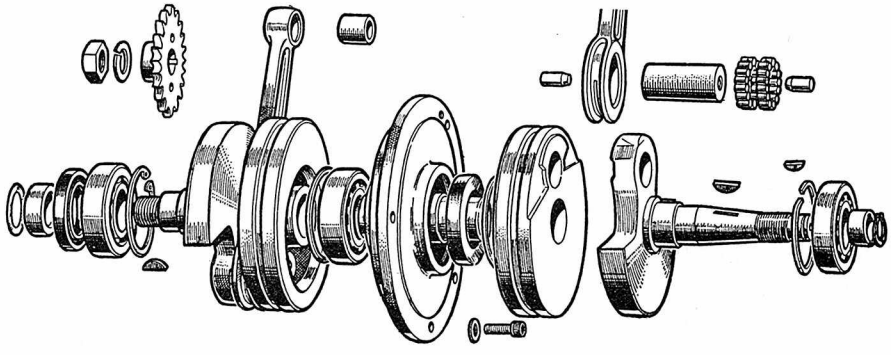


Fig. V30—Exploded view of 2T and 3T crankshaft and associated parts.

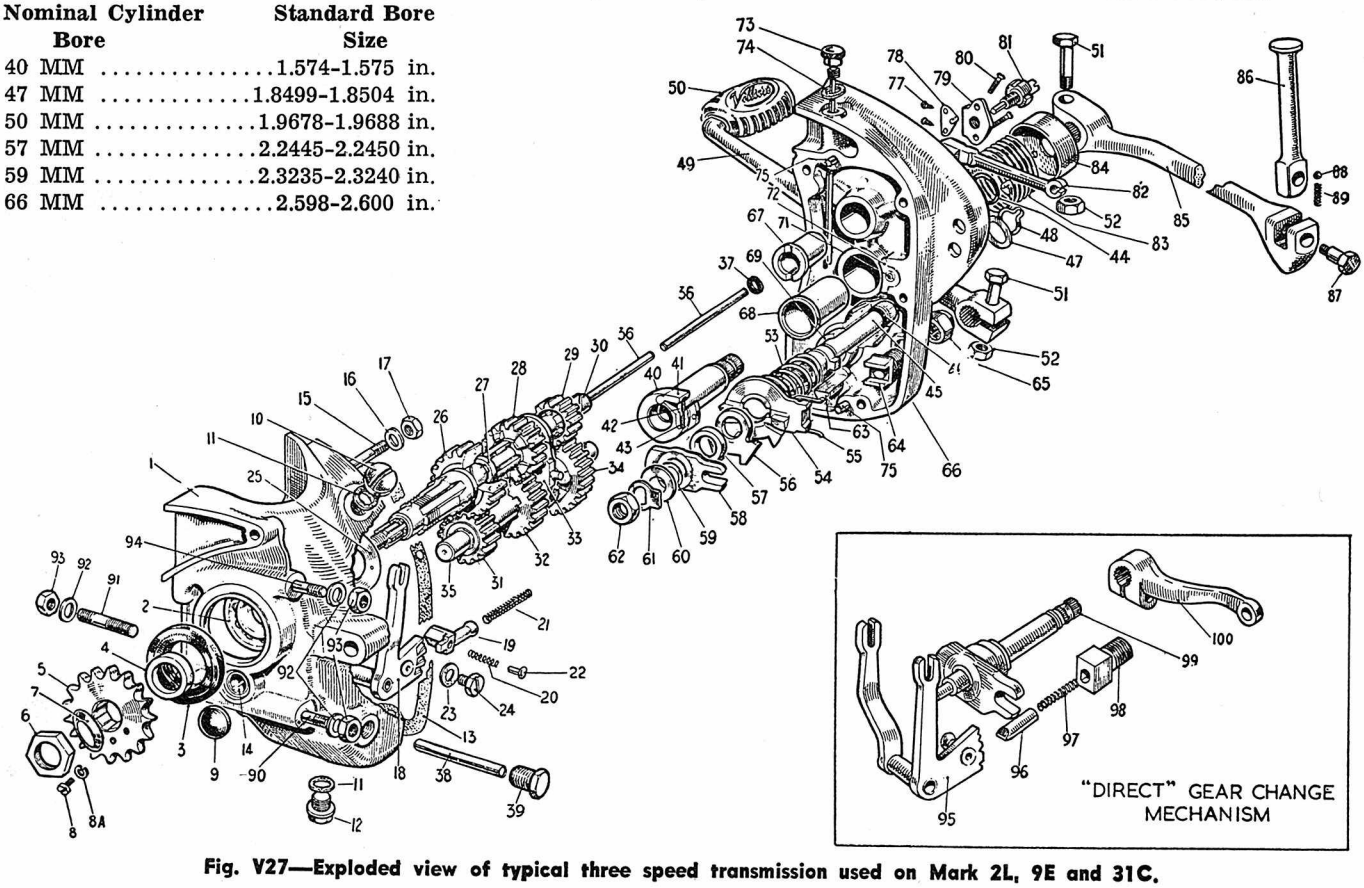


Fig. V27—Exploded view of typical three speed transmission used on Mark 2L, 9E and 31C.

CONNECTING ROD AND CRANKSHAFT. To remove the connecting rod and crankshaft assembly, it is first necessary to remove the cylinder head, cylinder, magneto, transmission, drive chain and crankshaft sprocket. Split the crankcase halves and remove the crankshaft assembly.

It is extremely important that crankshaft be perfectly true and therefore it is recommended that **ONLY** shops equipped with the necessary special tools replace crankpin, connecting rod and bearing.

To disassemble the crankshaft and rod assembly, it is necessary to press the crankpin from the crankshaft counterweights. Use 0.001 inch oversize crankpin and connecting rod if reusing crankshaft counterweights. Standard size crankpin and connecting rod are also available for service when new counterweights are being used. When reassembling, connecting rod side clearance should be 0.006-0.010 in. for 4F, 6F and 9F; 0.005-0.009 in. for all other models. Run-out of crankshaft must not exceed 0.001 inch after assembly.

Ball type main bearings are a tight push fit in crankcase halves. Heat crankcase halves to 250° F. in oven or immerse in boiling water before attempting to install bearings. As sealing of crankcase is very important it is advisable to always renew crankshaft seals whenever crankshaft is removed.

CLUTCH AND GEAR BOX. If the clutch shaft has been disassembled on 4F, 6F or 9F models, it is important that the clutch spring retaining nut be adjusted so that the effective width of the clutch assembly is between 3.665 and 3.680 inches when measured between outer end of large splines at left end of shaft and outer face of lockwasher securing the clutch spring retaining nut at other end of shaft.

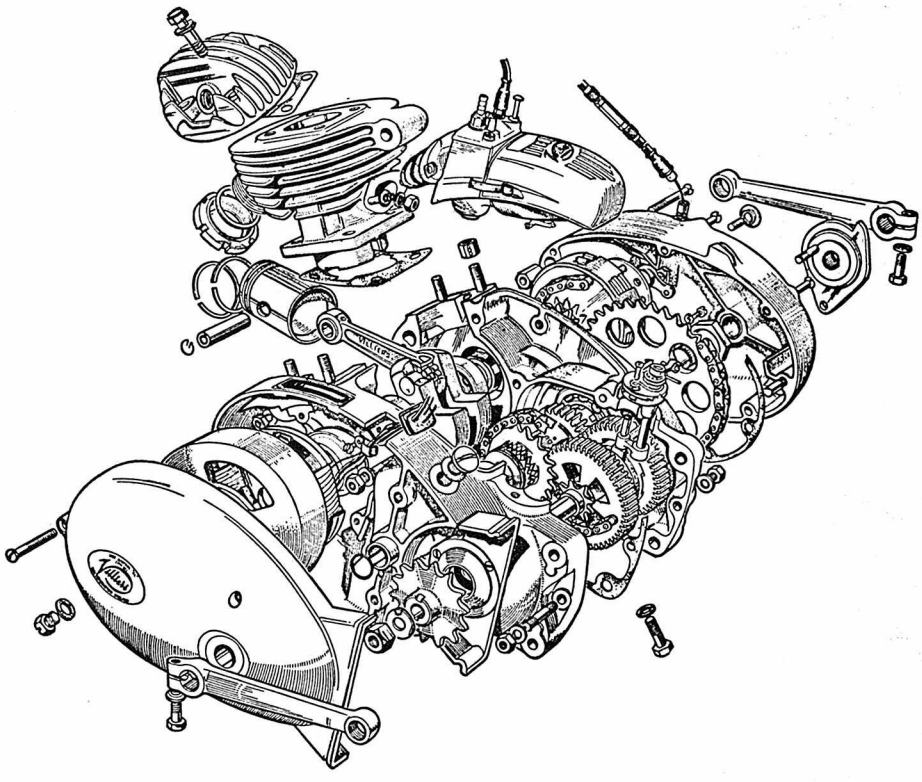


Fig. V31—Exploded view of 3K engine and gear box assembly.

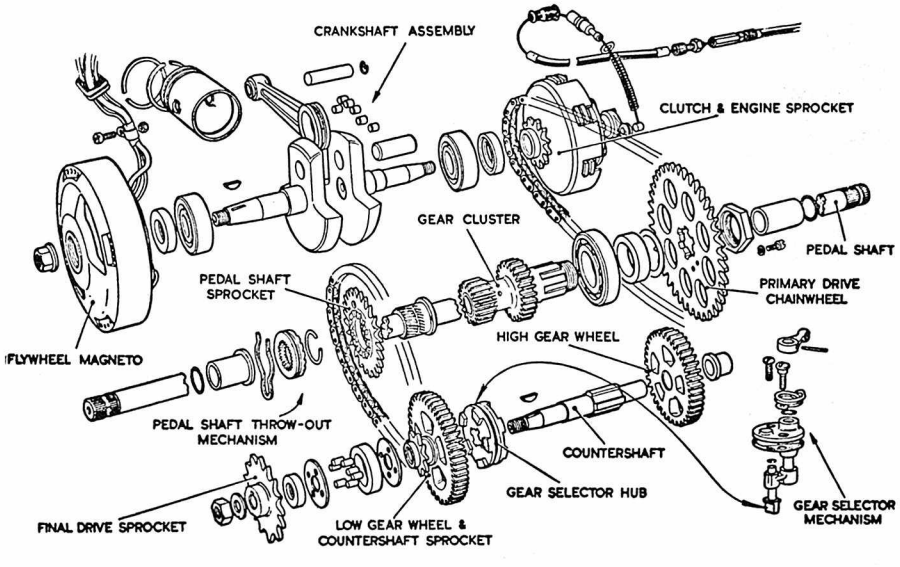


Fig. V32—Exploded view of 3K crankshaft and two speed transmission.

WHITE

250CC MODELS

MODEL	250 Shooting Star	250 Super Sport
Displacement-cc	246.83	246.83
Bore-MM	68	68
Stroke-MM	68	68
Number of cylinders	1	1
Oil-fuel ratio	1 to 20	1 to 20
Plug gap-inch	0.024	0.024
Point gap-inch	0.012-0.020	0.012-0.020
Ignition timing-Advance	Fixed	Fixed
Degrees BTDC	22	22
Electrical system voltage	6	6
Battery terminal grounded	Negative	Negative
Tire size-front	3.25 X 19	3.25 X 19
Rear	3.50 X 19	3.50 X 19
Tire pressure psi-front	22	22
Rear	28	28
Rear chain free play-inch	¾	¾
Number of speeds	4	4
Weight-lbs. (Approx.)	315	308

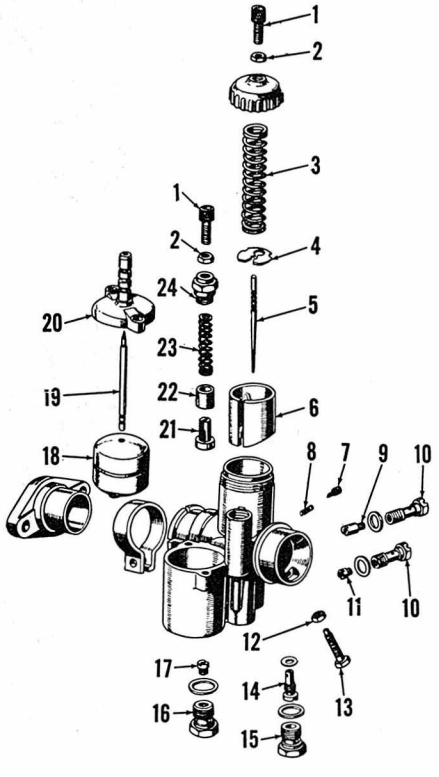


Fig. W1—Exploded view of carburetor used on 250cc models.

1. Cable adjusters
2. Lock nuts
3. Throttle closing spring
4. Clip
5. Valve needle
6. Throttle slide
7. Idle mixture adjusting needle
8. Spring
9. Idle jet
10. Jet holders
11. Main jet
12. Lock nut
13. Idle speed adjusting screw
14. Needle jet
15. Plug
16. Starter jet holder
17. Starter jet
18. Float
19. Float needle
20. Float cover
21. Starter valve
22. Guide
23. Spring
24. Cover

MAINTENANCE

SPARK PLUG. Recommended spark plug for normal use is Bosch W240 P11S. Electrode gap should be 0.6 MM (0.024 in.).

CARBURETOR. Refer to Fig. W1 for exploded view of carburetor. Main jet (11) size is 1.25 MM, idle jet (9) is 0.35 MM and needle jet (14) is 2.70 MM. Clip (4) should be installed in third groove from top of needle (5). Idle speed is adjusted to 500-600 rpm at stop screw (13). Idle mixture is adjusted at needle (7) on right side of carburetor.

IGNITION AND ELECTRICAL. Ignition breaker point gap should be 0.3-0.5 MM (0.012-0.020 in.). Ignition timing (points just open) should occur at 22 degrees BTDC. Piston position is 3.0 MM (0.118 inch) BTDC when crankshaft is 22 degrees BTDC. Ignition timing is changed by rotating the stator plate in the elongated holes after removing flywheel and loosening the three mounting screws.

LUBRICATION. The engine is lubricated by mixing SAE 30 motor oil with the fuel. Oil to gasoline ratio should be 1:15 for the first 900 miles, 1:20 after 900 miles. The gear box is lubricated by 1½ quarts of SAE 50 (SAE 40 in winter) oil.

CLUTCH CONTROL. Clutch control hand lever should have 2-3 MM 0.08-0.12 in.) free play at (A—Fig. W5). Adjustment is normally accomplished at cable adjuster (2—Fig. W6). If cable adjuster (2) is nearly screwed

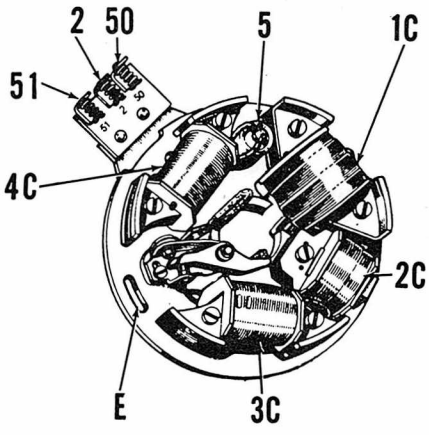


Fig. W3—View of complete magneto stator assembly.

E. Elongated stator mounting holes (3)
1C. Ignition coil
2. Ignition switch connection
2C. Battery charging coil
3C. Lighting coil
4C. Lighting coil
5. Condenser
50. Lighting current connector
51. Battery charging connector

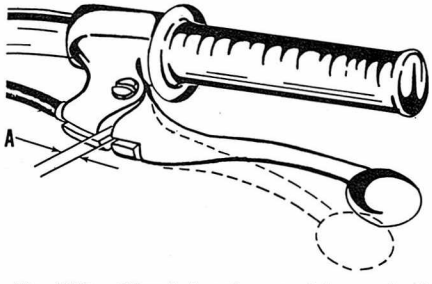


Fig. W5—Clutch hand control lever should have 0.08-0.012 in. free play at A. Refer to text for adjustment procedure.

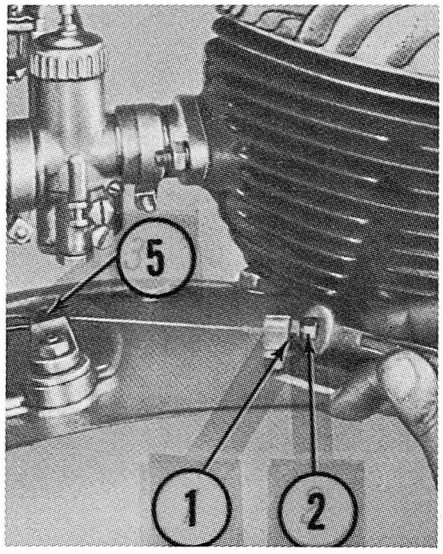


Fig. W6—Clutch adjustment is usually accomplished at cable adjuster (2). Clutch control arm is shown at (5) and adjuster locknut at (1).

out of adjuster block, additional adjustment is provided at clutch adjusting screw (3—Fig. W7) located under cover on left side. Adjustments are locked by nuts (1—Fig. W6 and 4—Fig. W7).

REPAIRS

PISTON, RINGS AND CYLINDER. To remove the piston, first remove the fuel tank, exhaust pipe, carburetor, cylinder head and cylinder. Piston and rings are available in standard size and two oversizes.

Piston-cylinder clearance

Above top ring	0.32 MM (0.0126 in.)
Below third ring	0.14 MM (0.0055 in.)
Bottom of skirt	0.08 MM (0.0032 in.)
Ring end gap	0.15-0.30 MM (0.0059-0.0118 in.)
wear limit	2.5 MM (0.0984 in.)

No cylinder head gasket is used. Make certain that mating surfaces of head and top of cylinder are clean and smooth.

CONNECTING ROD AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. With crankshaft at bottom dead center, side play of connecting rod at piston pin (top) end should not exceed 1 MM (0.04 in.). The connecting rod is removed by pressing crankshaft apart. Crankshaft should be disassembled **ONLY** if required tools are available to correctly check and align the reassembled crankshaft. With crankshaft supported at ends, eccentricity at main bearings should not exceed 0.01 MM (0.0004 in). Crankcase halves should be heated before installing main bearings.

CLUTCH. The clutch assembly can be removed after first removing the left crankcase cover. Primary drive chain should be renewed if deflection between sprockets exceeds 10 MM (0.4 in.). Clutch friction discs (10—Fig. W11) should be renewed if thickness is less than 3.5 MM (0.138 in.). Clearance of bushing (8) should not exceed 0.2 MM (0.008 in.). Spring screws (16) should be checked after tightening. If pressure plate (12) is cocked, loosen spring screws (16) as necessary to align pressure plate. Wire should be installed through heads of all four screws (16) to prevent change in setting.

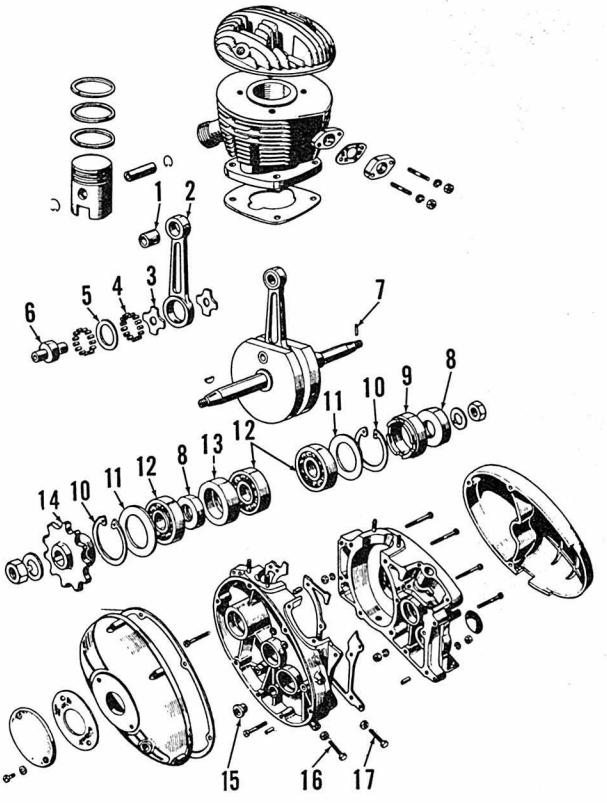


Fig. W9—Exploded view of engine crankshaft and crankcase. Primary drive sprocket (14) drives clutch via 3/8 inch X 3/8 inch X 6 MM single row chain.

1. Piston pin bushing
2. Connecting rod
3. Spacers (2 used)
4. Rollers (44 used)
5. Spacer
6. Crankpin
7. Magneto drive pin
8. Crankshaft seals
9. Seal housing
10. Snap rings
11. Shims
12. Main bearings
13. Seal housing
14. Primary drive sprocket
15. Bushing

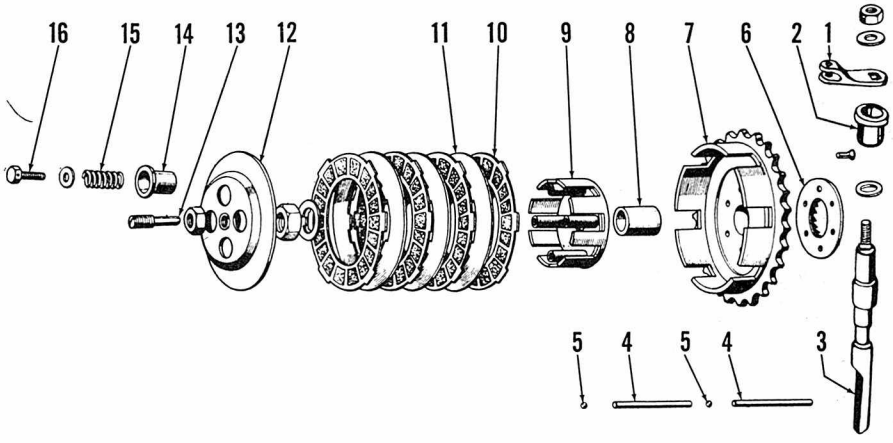


Fig. W11—Exploded view of clutch assembly. Push rods (4) are interchangeable.

1. Clutch release arm
2. Sleeve
3. Release cam shaft
4. Push rods
5. Bearings (7/32 in.)
6. Starter ratchet plate
7. Clutch drum and sprocket
8. Bushing
9. Clutch hub
10. Friction discs (4 used)
11. Drive plate (3 used)
12. Pressure plate
13. Adjusting screw
14. Spring cup (4 used)
15. Pressure spring (4 used)

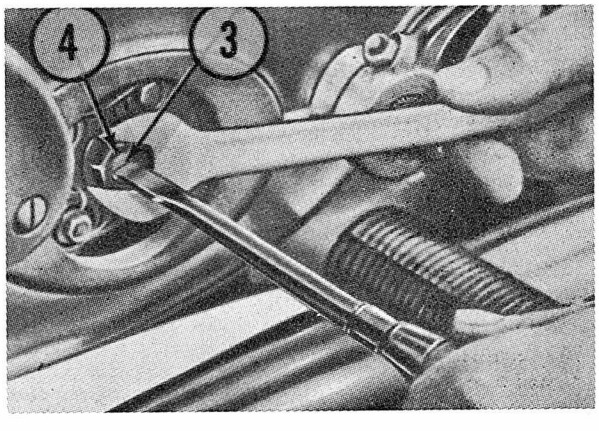


Fig. W7—Clutch adjustment can be accomplished at screw (3). Locknut (4) should be tightened after adjustment is complete.

GEAR SELECTOR. The gear selector assembly (Fig. W12) can be removed from top of transmission without further disassembly. If transmission jumps out of first and fourth gear, screws (16 & 17—Fig. W9) should be adjusted as follows. Shift into third gear and turn top stop screw (17) until it just touches stop plate on pedal shaft. Shift into second gear and turn bottom stop screw (16) until it just touches stop plate on pedal shaft. Adjustment of stop screws should be maintained by tightening locknuts. Shift the transmission into another gear and slowly release the shift pedal. Just before the shift pedal stops in the normal position, an audible click should be heard as the shift pawls (9—Fig. W12) fall into the next slots in shift plate (11). If shift pawls do not fall into slots, the return spring stationary pin (14) must be bent slightly using a hammer and drift. Check the centering position for upshift and downshift.

CRANKCASE AND GEARBOX. To disassemble the crankcase and gear box it is necessary to remove the engine. Remove both left and right crankcase covers, shifter assembly, clutch assembly, magneto and crankshaft sprocket (14—Fig. W9). Refer to Figs. W12, W14, W15 and W16.

The transmission assembly is shown in Fig. W14. Shims (3) are used to adjust side play of shafts. Refer to previous paragraph for adjustment procedure of gear selector.

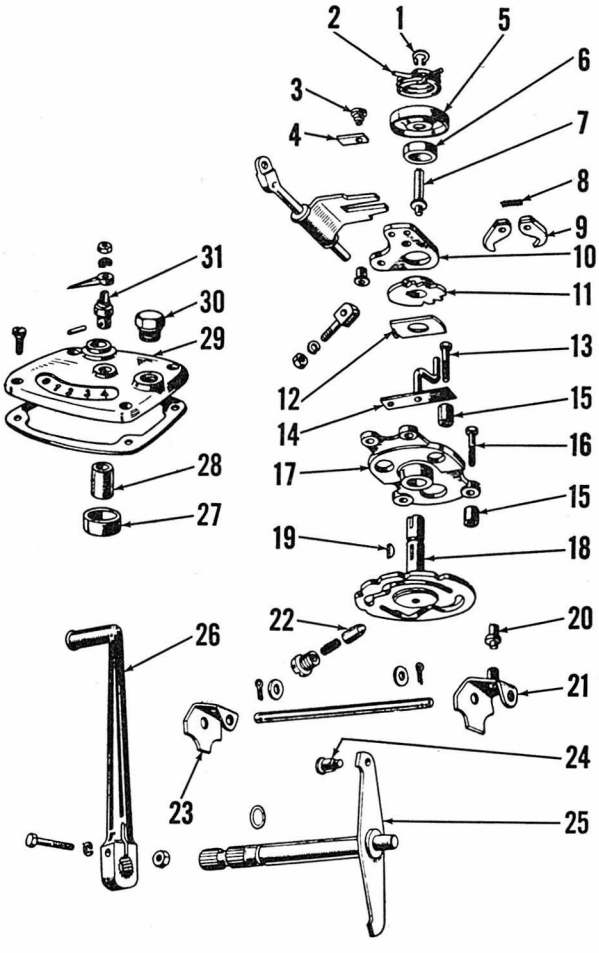


Fig. W12—Exploded view of shifting mechanism. Refer to text for adjustment.

1. Snap ring
2. Return spring
3. Pin
4. Insert
5. Spring cup
6. Spacer
7. Return spring pin
8. Pawl spring
9. Shift pawls (2 used)
10. Pawl plate
11. Shift plate
12. Throwout plate
13. Retaining screws
14. Return spring stationary pin and plate
15. Spacers
16. Retaining screws
17. Shifter housing
18. Shifter cam
19. Woodruff key
20. Fork pins (2 used)
21. Fork (right side)
22. Shift cam detent
23. Fork (left side)
24. Shift lever pin
25. Shift lever
26. Shift pedal
27. Centering spacer
28. Bushing
29. Top cover
30. Breather
31. Indicator spindle

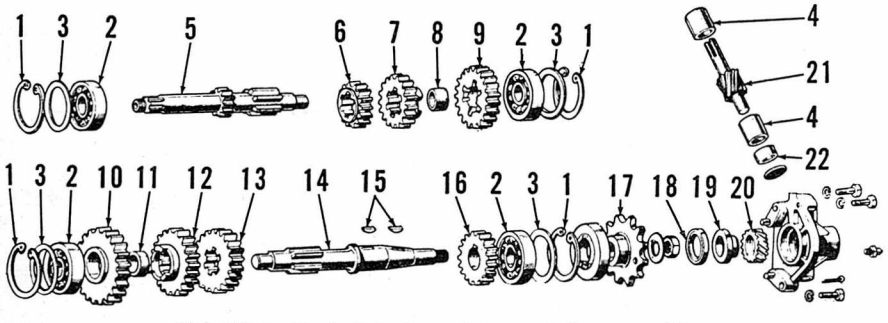


Fig. W14—Exploded view of transmission assembly.

1. Snap rings
2. Bearings
3. Shims
4. Bushings
5. Transmission input shaft and first gear
6. Second gear
7. Third gear
8. Bushing (fourth gear)
9. Fourth gear
10. First gear
11. Bushing (first gear)
12. Second gear
13. Third gear
14. Output shaft
15. Woodruff keys
16. Fourth gear
17. Output sprocket
18. Oil seal
19. Spacer
20. Speedometer drive gear
21. Speedometer driven gear
22. Spacer

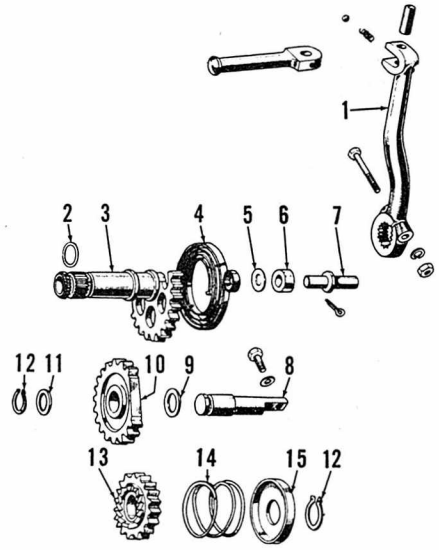


Fig. W15—Exploded view of kickstarter assembly. Ratchet (13) turns clutch drum ratchet (6—Fig. W11).

1. Kickstarter pedal
2. O ring
3. Kickstarter shaft and quadrant
4. Return spring
5. Washer
6. Rubber stop
7. Stop pin
8. Intermediate shaft
9. Washer
10. Intermediate gear
11. Washer
12. Snap rings
13. Ratchet gear
14. Spring
15. Spring cup

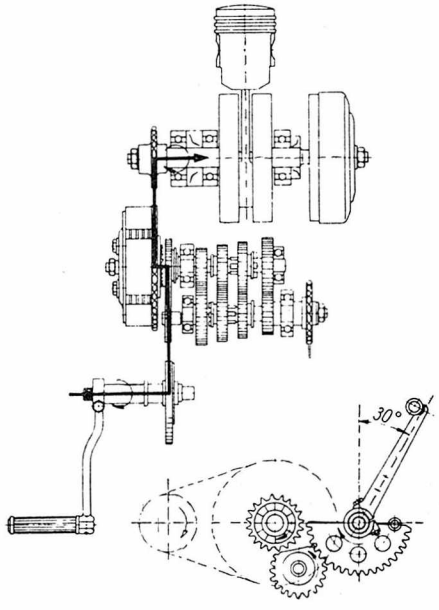


Fig. W16—Cross sectional view of transmission and kickstarter installation.

YAMAHA

YAMAHA INTERNATIONAL CORP.
Box 6600
Buena Park, CA. 90620

YF-1, MF-3, U5, YJ-1, YJ-2, MG1T AND YG-1 MODELS

MODEL	YF-1	MF-3, MF-3E, U5 & U-5E	YJ-1	YJ-2	MG1T	**YG-1
Displacement-cc	50	50	55	58	73	73
Bore-MM	40	40	42	42	47	47
Stroke-MM	40	40	40	42	42	42
Number of cylinders	1	1	1	1	1	1
Oil-fuel ratio	1 to 20	Oil Pump	1 to 20	Oil Pump	1 to 20	+1 to 20
Plug gap-inch	0.024-0.027					
Point gap-inch	0.008-0.016 See Text					
Ignition timing	Fixed					
Piston position BTDC-inch	0.079	0.071	0.079	0.071	0.079	(See text)
Electrical system voltage	6	*12	6	6	6	6
Battery terminal grounded	Negative	Negative	Negative	Negative	Negative	Negative
Tire size	2.25x17	2.25x17	2.25x17	2.25x17	2.50x16	2.50x17
Tire pressure-front	22	22	22	22	22	22
Rear	28	28	28	28	28	28
Rear chain free play-inch	½-⅝	½-⅝	½-⅝	½-⅝	½-⅝	½-⅝
Number of speeds	4	3	4	4	4	4
Weight-lbs. (approx.)	161	*165	161	161	168	162

*On U-5 models (without electric starter), electrical system is 6 volts and weight is 158 lbs.

**Variations such as YG-1TK and YGS-1 subdivide these models. In the text, where necessary, these subdivisions will be noted.

+Later YG-1 models are equipped with oil injection pump.

MAINTENANCE

SPARK PLUG. Recommended spark plug electrode gap is 0.024-0.027 inch (0.6-0.7MM) for all models. Recommended spark plug for normal use is NGK type B-7HZ or Champion L-81.

CARBURETOR. A Mikuni VM type carburetor is used on all models. Idle speed is changed by turning adjuster (2—Fig. Y1-1). Idle mixture is adjusted by turning needle (11). Float setting (H—Fig. Y1-2) should be 20.5MM ($\frac{13}{16}$ inch) for all models. Refer to Fig. Y1-1 and the following specifications:

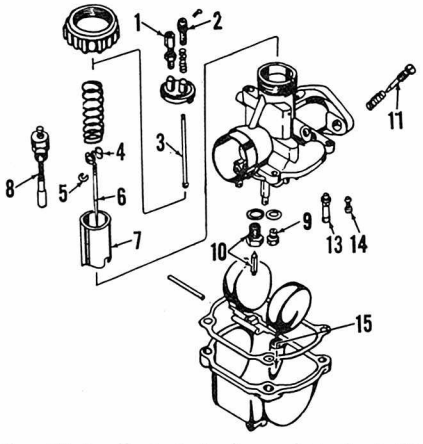


Fig. Y1-1—Exploded view of typical Mikuni VM carburetor.

1. Throttle cable adjuster
2. Idle speed adjuster
3. Idle speed rod
4. Spring seat
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Fuel inlet valve
11. Idle mixture needle
13. Needle jet
14. Pilot jet
15. Starting jet

MF-3, MF-3E, U-5 and U-5E (Early type with idle mixture needle (11) on side of carburetor).

Carburetor model VM14SC
Mark on carburetor 6E
Main jet (9) .....#100
Air jet 2.0
Needle jet (13) E-0
Jet needle (6) 3N2
Pilot jet (14) .....#17.5
Starter jet (15) .....#30
Idle mixture needle (11) normal setting—turns open 1¼
Clip (5) position in needle (6)—grooves from top 2

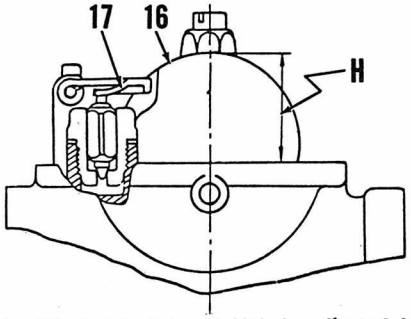


Fig. Y1-2—Float level (H) is adjusted by bending tang (17).

U-5 and U-5E (Late type with idle mixture needle (11) at open end of carburetor.)

Main jet (9) .....#140
Air jet 1.0
Needle jet (13) E-2
Jet needle 3G1
Idle mixture needle (11) normal setting—turns open 1½
Clip (5) position in needle (6)—grooves from top 3

YJ1

Carburetor model VM14SC
Main jet (9) .....#95
Air jet 0.5
Needle jet (13) E-0
Jet needle (6) 15F1
Pilot jet (14) .....#15
Starter jet (15) .....#30
Idle mixture needle (11) normal setting—turns open 1½
Clip (5) position in needle (6)—grooves from top 3

YF-1

Carburetor model VM14SC
Main jet (9) .....#95
Air jet 0.5
Needle jet (13) E-0
Jet needle (6) 15F
Pilot jet (14) .....#15
Starter jet (15) .....#30
Idle mixture needle (11) normal setting—turns open 1½
Clip (5) position in needle (6)—grooves from top 3

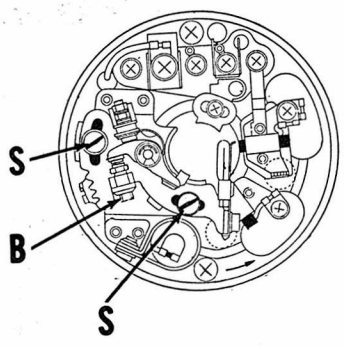


Fig. Y1-3—View of electric starting stator assembly. Breaker point gap is changed by turning screw (B) after loosening the lock nut. Ignition timing is changed by moving the plate in the elongated holes after loosening screws (S).

YJ2 (Early models)
Carburetor model VM14SC
Main jet (9) .....#100
Needle jet (13) E-0
Jet needle (6) 3G1
Pilot jet (14) .....#17.5
Starter jet (15) .....#30
Idle mixture needle (11) normal setting—turns open 1½
Clip (5) position in needle (6)—grooves from top 2

YJ2 (Late models)
Carburetor model VM16SC
Main jet (9) .....#60
Needle jet (13) E-0
Jet needle (6) 3D1
Pilot jet (14) .....#17.5
Starter jet (15) .....#15
Idle mixture needle (11) normal settings—turns open 1¾
Clip (5) position in needle (6)—grooves from top 3

MG1T
Carburetor model VM15SC-1
Mark on carburetor .....B
Main jet (9) .....#100
Air jet 0.5
Needle jet (13) E-0
Jet needle (6) 15F1
Pilot jet (14) .....#20
Starter jet (15) .....#20
Idle mixture needle (11) normal setting—turns open 1½
Clip (5) position in needle (6)—grooves from top 3

YG1 and YG1-T
Carburetor model VM15SC-1
Mark on carburetor .....A
Main jet (9) .....#100
Air jet 0.5
Needle jet (13) E-0
Jet needle (6) 3G1
Pilot jet (14) .....#20
Starter jet (15) .....#20
Idle mixture needle (11) normal settings—turns open 1½
Clip (5) position in needle (6)—grooves from top 3

YG1-K and YG1-TK
Carburetor model VM15SC-1
Mark on carburetor .....D
Main jet (9) .....#100
Air jet 0.5
Needle jet (13) E-2
Jet needle (6) 3G1
Pilot jet (14) .....#17.5
Starter jet (15) .....#40
Idle mixture needle (11) normal setting—turns open 1¾
Clip (5) position in needle (6)—grooves from top 2

YGS-1 and YGS-1T
Carburetor model VM15SC
Mark on carburetor .....SA
Main jet (9) .....#120
Air jet 0.5
Needle jet (13) E-2
Jet needle (6) 3G1
Pilot jet (14) .....#17.5
Starter jet (15) .....#40
Idle mixture needle (11) normal setting—turns open 1½
Clip (5) position in needle (6)—grooves from top 3

IGNITION AND ELECTRICAL. A generator-starter unit is mounted at the left end of the crankshaft on electric starting MF-3E and U-5E models; all other models use a flywheel type magneto. Refer to appropriate following paragraphs:

Electric Starting Models. A 12 volt combined starter, generator and ignition unit is mounted on the left side of the engine. Ignition breaker point gap should be 0.012-0.014 inch. To set the ignition timing, set piston at 1.8MM (0.071 inch) BTDC. When piston reaches this position, the breaker points should just open with ignition timing fully advanced. If timing is incorrect, loosen the two screws (S—Fig. Y1-3) and move the breaker plate assembly. Be sure to recheck after screws are tightened.

All Kick Starting Models. The ignition primary coil, condenser, breaker points and electrical system charging coil are located under the flywheel at left end of crankshaft. Ignition breaker point gap should be set so that points just open when the piston is correct distance BTDC.
Refer to the following ignition timing positions:

MODEL	Piston Position	BTDC
YF-1	0.079 in.	2.0MM
MF-3 & U-5	0.071 in.	1.8MM
YJ-1	0.079 in.	2.0MM
YJ-2	0.071 in.	1.8MM
MGIT & YG-1	0.079 in.	2.0MM

Breaker point gap is used to change ignition timing, but maximum gap should be within range of 0.008-0.016 inch after timing is correctly set. Some models have timing marks on flywheel and magneto stator plate.

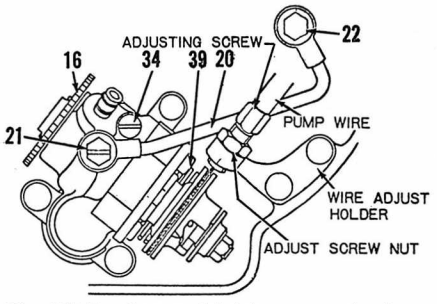


Fig. Y1-5—System bleeder screw is shown at 34. Refer to Fig. Y1-7 for legend.

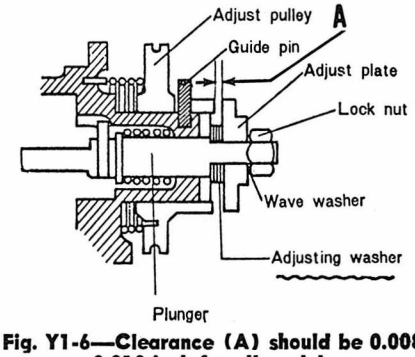


Fig. Y1-6—Clearance (A) should be 0.008-0.010 inch for all models.

LUBRICATION. On models without "Autolube", the engine is lubricated by SAE 30 motor oil mixed with the fuel. Normal ratio is 1:20. On models with "Autolube" a separate oil tank and metering type pump is used. Refer to the "Autolube" section which follows.

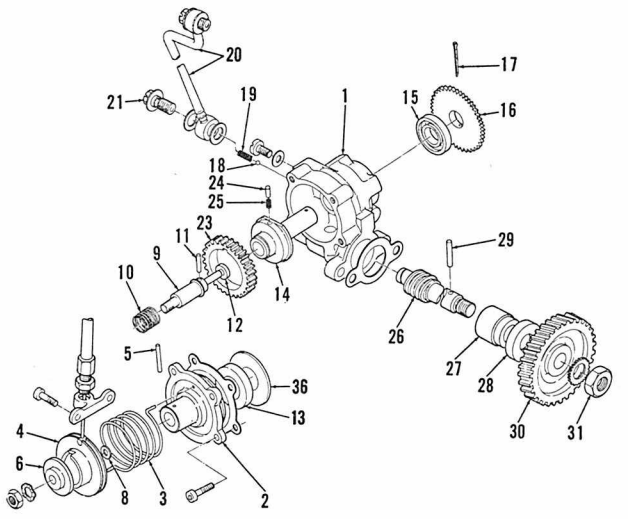
The gear box on all models is lubricated by approximately 1 pint of Yamaha Gear Oil B or SAE 20W/40 multigrade engine oil.

"AUTOLUBE". The Yamaha "Autolube" is an automatically metering, engine lubricating system. A separate oil tank, an oil pump and metering unit and delivery nozzle is used. For use above 20°F., SAE 30 two-stroke oil is recommended. For temperatures below 20°F., SAE 10W/30 oil should be used. The oil tank should **never** be allowed to run dry.

The automatic metering system varies the fuel to oil mixture from 16:1 at full throttle to approximately 120:1 at idle, no load. The oil pump and metering unit is located under the right side cover.

If the "Autolube" system is drained or the pump unit is renewed, the air should be bled from the system by removing screw (34—Fig. Y1-5) and turning starter plate (16) until oil runs freely from the bleed hole, then reinstall bleed screw.

To adjust the oil metering system, first adjust the engine idle speed. Ad-



1. Pump case
2. Cover
3. Adjust pulley spring
4. Adjust pulley
5. Pulley guide pin
6. Adjust plate
8. Shims
9. Plunger
10. Plunger return spring
11. Cam guide pin
12. Plunger oil seal
13. Plunger cam oil seal
14. Distributor
15. Distributor oil seal
16. Starter plate
17. Drive pin
18. Check ball
19. Check valve spring
20. Delivery pipe
21. Banjo bolts
23. Worm wheel
24. Worm wheel pin
25. Spring
26. Worm shaft
27. Worm shaft collar
28. Oil seal
29. Pin
30. Drive gear
36. Worm wheel plate

Fig. Y1-7—Exploded view of oil pump and metering unit used on YGS1 models. Other models with "AUTOLUBE" are similar.

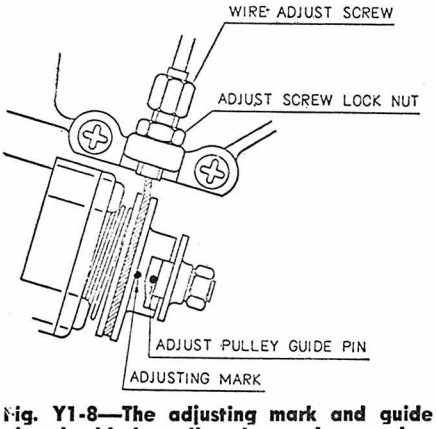


Fig. Y1-8—The adjusting mark and guide pin should be aligned as shown when throttle is half open.

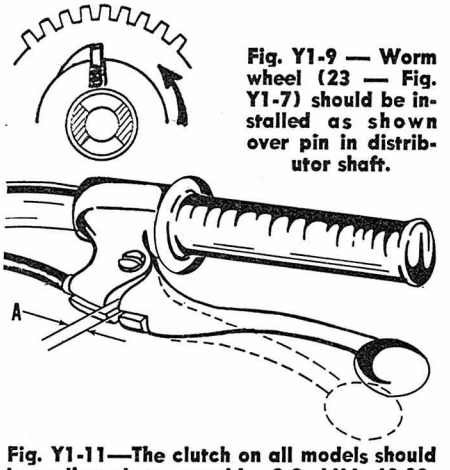


Fig. Y1-9 — Worm wheel (23 — Fig. Y1-7) should be installed as shown over pin in distributor shaft.

Fig. Y1-11—The clutch on all models should be adjusted to provide 2-3 MM (0.08-0.12 in.) clearance at A.

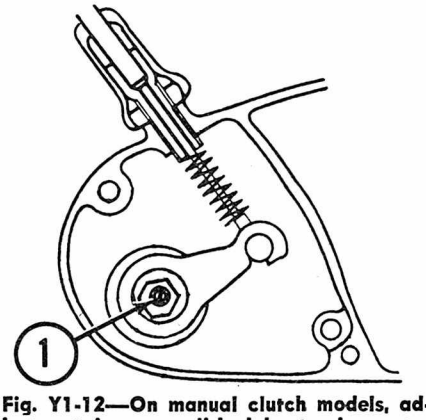


Fig. Y1-12—On manual clutch models, adjustment is accomplished by turning screw (1) after loosening the lock nut. Adjusting screw (1) is accessible through hole on right side cover after removing the rubber plug.

just throttle cable to $\frac{1}{16}$-inch slack at hand lever end. Check minimum plunger stroke by turning starter plate (16) until clearance (A—Fig. Y1-6) between adjusting pulley and adjusting plate is at its minimum. Clearance (A) should be 0.008-0.010 inch. If clearance is incorrect, add or deduct adjusting washers shown in Fig. Y1-6. Synchronize pump and throttle cables as follows: Open throttle half way using hand control until the "O" on carburetor throttle slide is at top of throttle bore. Adjust pump cable until pulley guide pin and mark align as shown in Fig. Y1-8. Open throttle fully and make certain guide pin is not touching end of notch.

When disassembling, refer to Fig. Y1-7. Make certain worm wheel (23) is installed over pin as shown in Fig. Y1-9.

CLUTCH CONTROLS. The automatic clutch engagement speed on MF-3 and U-5 should be approximately 1800 rpm. Point of engagement is not adjustable except by renewing faulty parts. Refer to the appropriate paragraphs in the REPAIRS section.

The clutch hand lever on all models except MF-3 and U-5 should have 0.08-0.12 inch free play at (A—Fig. Y1-11). Adjustment is accomplished by turning the adjusting screw (1—Fig. Y1-12).

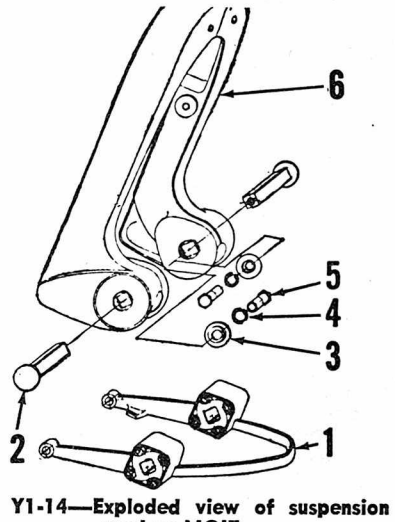


Fig. Y1-14—Exploded view of suspension used on MGIT.

1. Front suspension arm
2. Square stem
3. Washer
4. Lock washer
5. Screw
6. Front fork

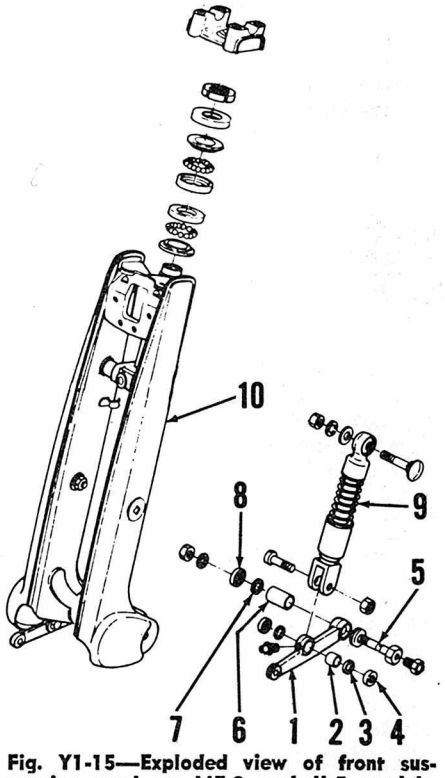


Fig. Y1-15—Exploded view of front suspension used on MF-3 and U-5 models.

1. Suspension arm
2. Spacer
3. Felt (2 used each side)
4. Cover (2 used each side)
5. Pivot
6. Spacer
7. Felt (2 used each side)
8. Cover (2 used each side)
9. Suspension unit
10. Front fork

SUSPENSION. Refer to Fig. Y1-14 and Y1-15 for suspension used on MG1T, MF-3 and U-5 models.

Refer to Fig. Y1-16 for suspension typical of all models with telescopic front suspension. Each unit contains 130cc of oil. Oil used should be a mixture of two parts SAE 60 spindle oil

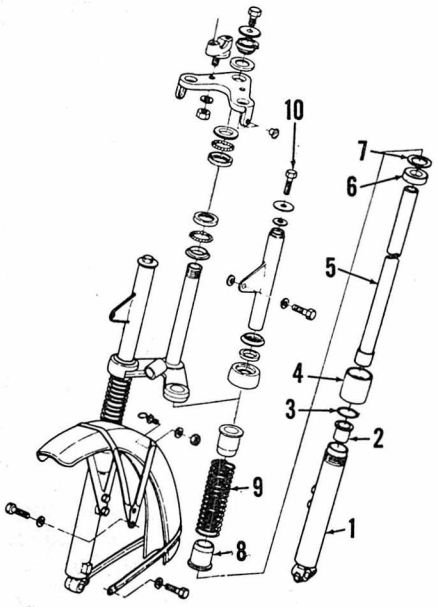


Fig. Y1-16—Exploded view of suspension unit used on YG1 models. Other models with telescopic front suspension are similar.

1. Lower tube
2. Bushing
3. O ring
4. Tube nut
5. Inner tube
6. Oil seal
7. Seal washer
8. Spring seat
9. Spring
10. Filler screw

and eight parts SAE 30 motor oil. Fill the suspension unit at screw (10).

Rear suspension units should be renewed if bent, leaking or damaged.

REPAIRS

PISTON, RINGS AND CYLINDER. The piston can be removed after removing exhaust pipe, cylinder head and cylinder. Standard cylinder bore diameter is 40MM (1.575 inch) for 50cc models, 42MM (1.654 inch) for 55 and 60cc models, 47MM (1.850 inch) for 73cc models. Refer to the following specification data:

Ring end gap .....0.006-0.014 inch
Ring side clearance in grooves—
Top ring .....0.0016-0.0031 inch
Second ring ....0.0012-0.0027 inch
Piston skirt to cylinder clearance—
MF-3 & U-5 without electric starter .....0.0012-0.0014 inch
MF3E & U-5E with electric starter .....0.0014-0.0016 inch
YF1 & YJ2 .....0.0014-0.0016 inch
80cc Models .....0.0016-0.0017 inch
Taper or out of round limit 0.002 inch

Piston skirt clearance should be measured at right angles to piston pin and at tightest point in cylinder. Lower ring is dark (parkerized) and top ring is chrome plated. Rings should be installed with marked side toward top of piston. Piston must be installed with arrow on top aimed toward exhaust (front) port. Piston should be heated before installing the piston pin.

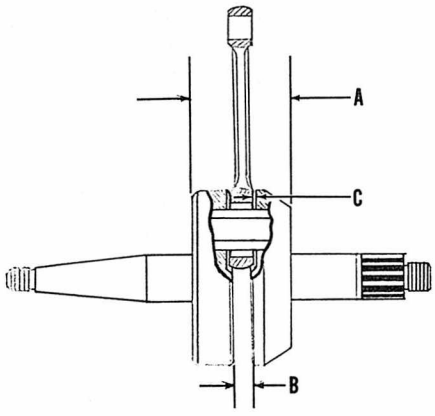


Fig. Y1-18—When assembling the crankshaft, observe the dimensional data included in text. Dimension (A) is distance between outside of crankshaft counterweights. Distance (B) is between inside of counterweights. Distance (C) is connecting rod side clearance.

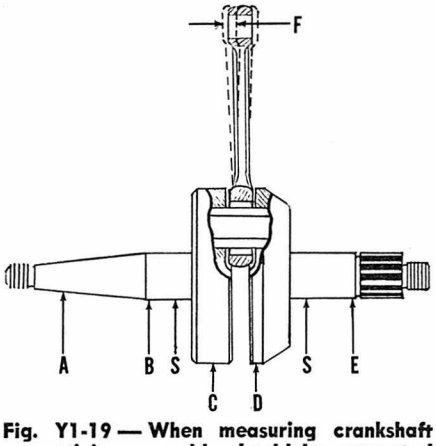


Fig. Y1-19 — When measuring crankshaft eccentricity, assembly should be supported in V blocks at points (S). Refer to text for limits.

CONNECTING ROD AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Connecting rod, crankpin and roller bearing are removed by pressing crankshaft apart. Crankshaft should be disassembled **only** if required tools are available to correctly check and align the reassembled crankshaft. Refer to the following crankshaft specifications:

Refer to Fig. Y1-18
When crankshaft is assembled
A should be ....1.6890-1.6944 inch
B should be .....0.315 inch
C should be .....0.008-0.015 inch

Refer to Fig. Y1-19
Connecting rod play (F) ..0.031 inch
Wear limit .....0.118 inch
Eccentricity limit measured at—
A. .....0.00118 inch
C. .....0.00236 inch
D. .....0.00236 inch
E. .....0.00118 inch

CLUTCH (MF-3 and U-5). The automatic clutch is located on the right end of the transmission input shaft. To remove the clutch, it is necessary

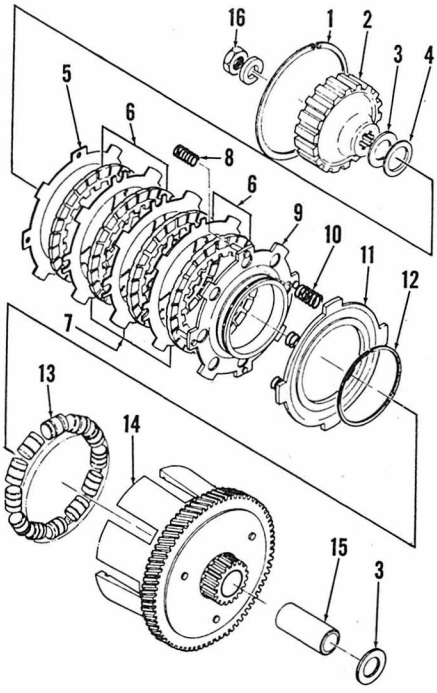


Fig. Y1-21—Exploded view of the automatic clutch used on MF-3 and U-5 models.

1. Snap ring
2. Clutch hub
3. Thrust plate (2 used)
4. Washer
5. Clutch plate
6. Friction discs (4 used)
7. Clutch plates (3 used)
8. Release springs (4 used)
9. Pressure plate
10. Clutch springs (8 used)
11. Roller thrust plate
12. Snap ring
13. Rollers (12 used)
14. Clutch drum
15. Spacer
16. Nut

to remove carburetor cover, carburetor and the engine right side cover. Remove snap ring (1—Fig. Y1-21) and withdraw friction discs (6), plates (5 & 7) and release springs (8). Clutch hub (2) and drum can be removed after removing nut (16).

Make certain that release spring pins on pressure plate (9) are not bent or damaged. Check all parts for overheating, wear and warpage.

CLUTCH (All Models With Manual Clutch). The multiple disc, wet type clutch is located on the right end of the transmission input shaft. To remove the assembly, it is necessary to remove the carburetor cover, carburetor and the engine right side cover.

Clutch plates (11—Fig. Y1-22) are 0.08 inch thick and friction discs (13) are 0.102 inch thick. Check all parts for evidence of overheating, wear and warpage.

CRANKCASE AND GEAR BOX. (MF-3 and U-5). The crankcase halves can be separated after removing the engine from the frame. Remove the piston, clutch, rotary valve assembly, magneto (or starter-generator) assembly, kick starter idler gear and the

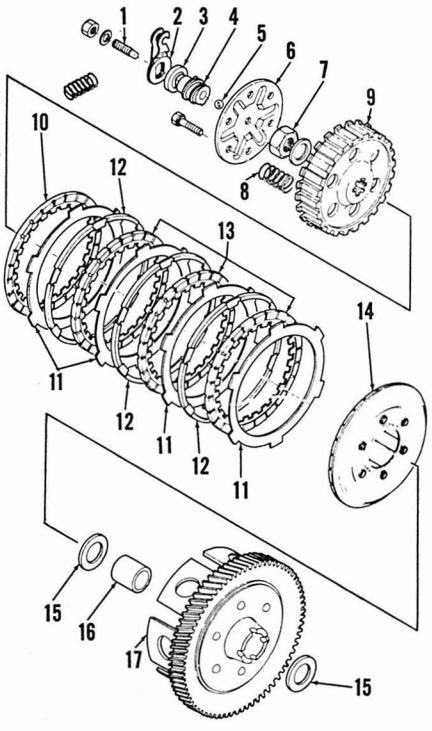


Fig. Y1-22 — Exploded view of manual clutch assembly. On YJ-1 models, only two friction discs (13), two cushion rings (12) and three clutch plates (11) are used.

1. Adjusting screw
2. Release lever
3. Oil seal
4. Release screw
5. Ball (⅜ inch)
6. Spring plate
7. Nut
8. Clutch spring (6 used)
9. Clutch hub
10. End disc
11. Clutch plates
12. Cushion rings
13. Friction discs
14. Pressure plate
15. Thrust washer
16. Spacer
17. Clutch drum

gear shift mechanism. Remove the screws joining halves together and separate the crankcase halves.

Fig. Y1-24 — Exploded view of the three speed transmission used in MF-3 and U-5 models.

2. Cluster gear
3. Snap rings
4. Bearings
6. Washer
7. Ball retainer springs
8. Output shaft
9. Shift balls (12 used)
10. Spacer
12. Collar
16. Shift rod
19. Third gear
20. Second gear
21. First gear
22. Kickstarter idler gear
23. Washer
24. Wave washer
25. Output sprocket

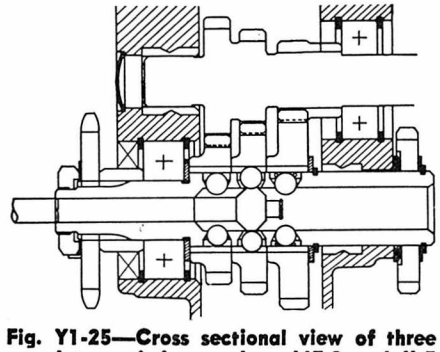


Fig. Y1-25—Cross sectional view of three speed transmission used on MF-3 and U-5 models.

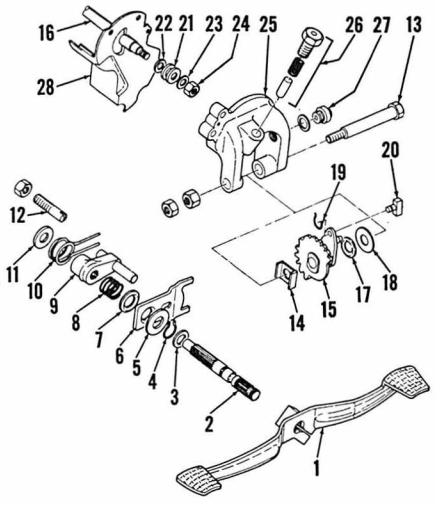


Fig. Y1-26—Exploded view of YG-1 shift assembly. Other models are similar. The complete shift rod (16) is also shown in Figs. Y1-24 and Y1-27.

1. Shift pedal
2. Shaft
3. Shim
4. Snap ring
5. Washer
6. Change fork
7. Spring cover
8. Spring
9. Change lever
10. Return spring
11. Washer
12. Spring stud
13. Shaft screw
14. Thrust plate
15. Shift plate
16. Shift rod
17. Wave washer
18. Thrust washer
19. Snap ring
20. Shift lug
21. Shift collar
22. Shims
23. Lock washer
24. Nut
25. Bracket
26. Detent assembly
27. Neutral switch
28. Dust cover

When assembling, position gears and shafts in the left crankcase; coat the mating surface with "Yamaha Bond No. 5" or equivalent sealer, then install the right crankcase. When installing kickstarter gear (22—Fig. Y1-24), make sure wave washer (24) is between washer (23) and gear. Small diameter of wave washer (24) should be toward gear (24).

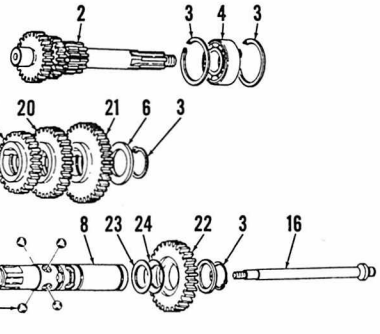


Fig. Y1-27 — Exploded view of four speed transmission typical of all models except MF-3 and U-5.

2. Cluster gear
3. Snap rings
4. Bearings
5. Retainer
6. Washer
7. Ball springs
8. Output shaft
9. Shift balls (16 used)
10. Spacer
12. Collar
16. Shift rod
18. Fourth gear
19. Third gear
20. Second gear
21. First gear
25. Output sprocket

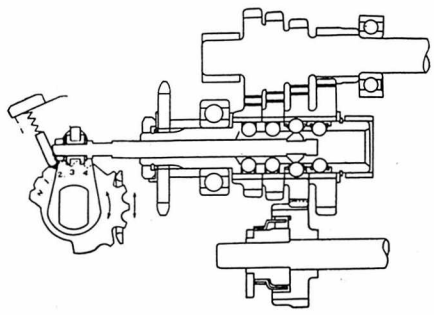
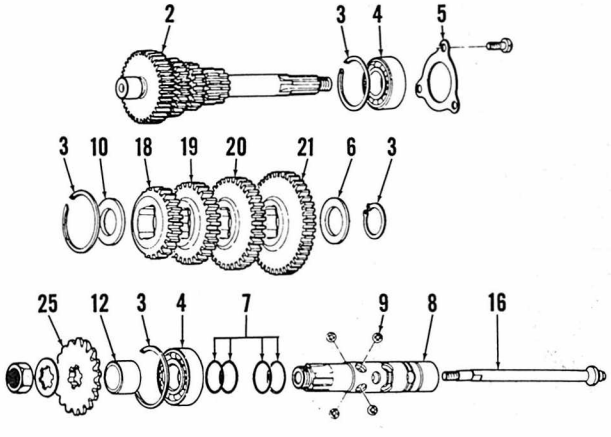


Fig. Y1-28—Cross sectional view of four speed transmission typical of all models except MF-3 and U-5.

CRANKCASE AND GEAR BOX (All Models Except MF-3 and U-5). The crankcase halves can be separated after removing the engine from the frame. Remove the piston, clutch and rotary valve assembly. The rotary valve located on right end of crankshaft is attached to the crankshaft with a roll pin. Care should be taken to prevent valve from absorbing water or becoming too dry. After valve is washed in a cleaning solvent, be sure to wipe with oil to prevent complete drying out. Thickness is 3.95-4.00MM (0.1545-0.1575 in.) and should be renewed if wear exceeds 0.4MM (0.01575 in.). Remove the magneto assembly and gear shift mechanism. Remove the screws attaching halves together and separate the crankcase halves.

When assembling, position gears and shafts in the left crankcase, coat the mating surface with "Yamaha Bond No. 5" or equivalent sealer, then install the right crankcase.

Refer to Figs. Y1-27 and Y1-28 for views of 4 speed transmission assembly. The head of the shifter rod (16—Fig. Y1-27) should be directly under shifter ball holes in the output shaft (8) when detent (26—Fig. Y1-26) engages notches in shift plate (15). If alignment of shifter head is incorrect, adjustment can be accomplished by changing the thickness of shims (22). Adjustment should only be accomplished with right side of crankcase



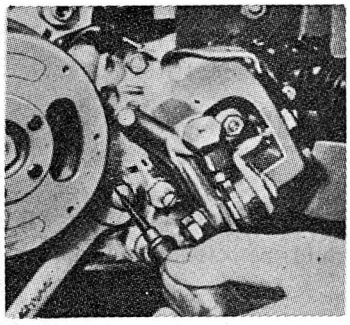


Fig. Y1-29—Over shift can be corrected by turning the eccentric screw as shown. Refer to text.

removed so alignment of shifter head can be observed. If the shift pedal moves the shift plate (15) past the notches for detent (26), turn the eccentric screw as shown in Fig. Y1-29.

SPEED TUNING

A "GYT" kit is available for the YG-1 model. Some features of the YG-1 "GYT" kit may be incorporated into standard YG-1 parts. The following modifications may improve performance of YG-1 models. Any modification of standard parts or installation of performance parts will void any warranty.

SPARK PLUG. An NGK type B-8HN or B-9HN racing plug is recommended. Final choice of plug depends on carburetor jetting and other variables.

CARBURETOR. A 22 MM unit is recommended with the following jet sizes:

Main jet .....#250-280
Jet needle .....#22 M
Throttle slide .....#2.5

Jet needle clip in third groove from top of needle.

It will be necessary to use the "GYT" kit rotary valve cover with the 22 MM carburetor as bore of standard valve cover is not large enough to accept the larger unit.

Match port of right crankcase with port in rotary valve cover. Reshape passages to ease air flow.

A standard valve may be modified to specifications in Fig. YT1-1.

PISTON, CYLINDER AND HEAD. Cut a notch 5 MM (0.197 in.) by approximately 26 MM (1.0 in.) in rear of piston skirt next to rear transfer port. Edges of notch should match edges of transfer port.

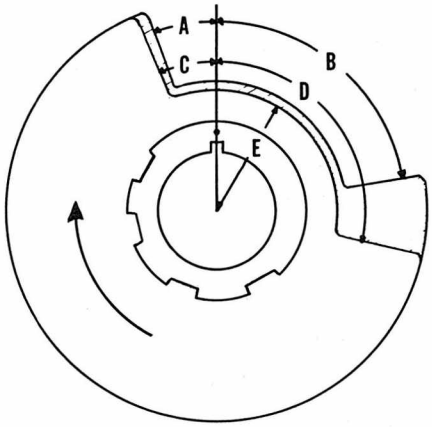


Fig. YT1-1—Rotary valve modifications for "GYT" specifications.

A. 25 degrees (Std.)
B. 100 degrees (Std.)
C. 26 degrees (Modified)
D. 121 degrees (Modified)
E. 28.5 MM (1.12 in.) radius

Mill head 2 MM (0.078 in.) and reshape taper in combustion chamber. Cooling fins must also be reshaped to restore clearance between head and cylinder.

Cut 2 MM (0.078 in.) from top of all transfer ports and raise exhaust port 3.5 MM (0.137 in.).

YAMAHA 90 CC AND 100 CC TWINS

MODEL	YL-1, YL-1E	HS-1 HS-1B
Displacement-cc	98	89
Bore-MM	38	36.5
Stroke-MM	43	43
Number of cylinders	2	2
Engine oiling system	Oil Injection	
Plug gap-inch	0.024-0.027	0.024-0.027
Point gap-inch	0.012-0.014	0.012-0.014
Ignition timing	Fixed	Fixed
Inches BTDC	0.071	0.071
Electrical system voltage	12	12
Battery terminal grounded	Negative	Negative
Tire size	2.50x17	2.50x18
Tire pressure-front	22 PSI	22 PSI
Rear	28 PSI	28 PSI
Rear chain free play-inch	½-⅝	¾
Number of speeds	4	5
Weight-lbs. (approx.)	180	199

MAINTENANCE

SPARK PLUGS. Recommended spark plug electrode gap is 0.024-0.027 inch (0.6-0.7MM). Recommended spark plug for normal use in the YL-1 is NGK type B7HZ or Champion L-81. Recommended spark plug for normal use in the HS-1 is NGK type B-9HC or a Champion type L-57R.

CARBURETORS. Two Mikuni VM carburetors are used. Idle speed should be set to 1200-1500 RPM for YL-1 models; 1100-1200 RPM for HS-1 models. Adjust idle speed by turning adjusters (2—Fig. Y2-1). Make sure that throttle slides (7) both stop at the same position and exhaust pressure is the same for both cylinders. Idle mixture is changed by turning needles (11). Initial setting 2½ turns open for YL-1 models; 1½ turns open for HS-1 models. Turning the needle counter-clockwise leans the mixture. Carburetors must be synchronized to open exactly the same amount by turning cable guides (1) on top of carburetors. Float level (H—Fig. Y2-2) should be 0.906 inch (23MM) and is adjusted by bending tang (17) on float. Refer to Fig. Y2-1 and the following standard specifications:

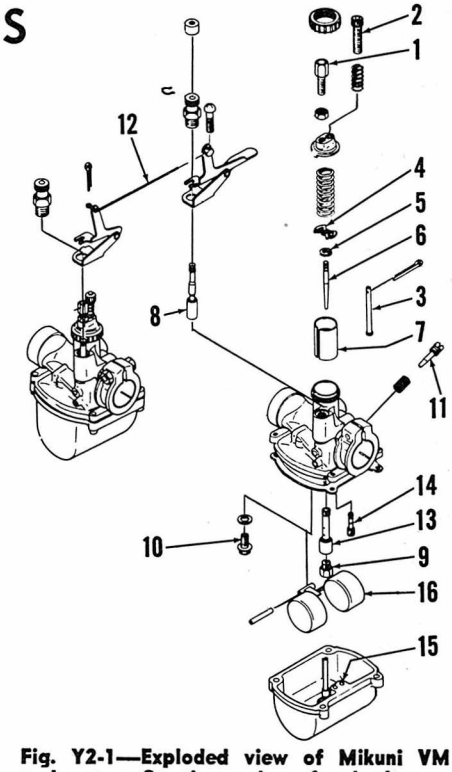


Fig. Y2-1—Exploded view of Mikuni VM carburetor. Starting valves for both carburetors are connected with rod (12).

1. Throttle cable guide
2. Idle speed adjuster
3. Idle speed rod
4. Retainer
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Fuel inlet valve
11. Idle mixture needle
12. Link rod
13. Needle jet
14. Pilot jet
15. Starting jet
16. Float

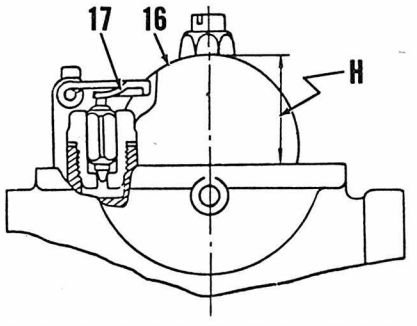


Fig. Y2-2—Float level (H) is adjusted by bending tang (17).

YL-1 Carburetor

Main jet (9) .....#55 or 60
Pilot jet (14) .....#17.5
Needle jet (13) E-0
Valve needle (6) 3D3
Clip (5) in third groove from top of needle (6).

HS-1 Carburetor

Main jet (9) ..... #70
Pilot jet (14) ..... #20
Needle jet (3) ..... E-O
Valve needle (6) 3G9
Clip (5) in fourth groove from top of needle (6).

IGNITION AND ELECTRICAL. Both YL-1 and HS-1 models use a battery ignition system with the generator mounted on the left end of the crankshaft. Breaker points and condensers are mounted on the generator stator. YL-1E models are equipped with a starter-generator unit providing electric starting.

Ignition breaker point gap should be 0.012-0.014 inch. Ignition should occur (breaker points just open) when the piston is 0.071 inch (1.8MM) BTDC. To check ignition timing, set one piston at 0.071 inch BTDC and move the breaker point assembly in the elongated mounting holes after loosening the two attaching screws. Timing for each cylinder must be set separately and exactly the same. The timing marks on cam should be aligned with the mark on plate (P—Fig. Y2-4) when pistons are 0.071 inch BTDC. A static timing light or meter

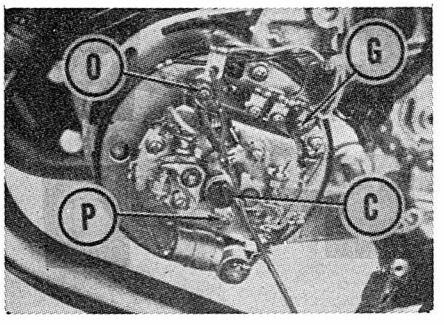


Fig. Y2-4—Timing marks on plate (P) and cam (C) should be aligned when piston is correct distance BTDC. Orange wire (O) is for left cylinder, gray wire (G) is for right cylinder.

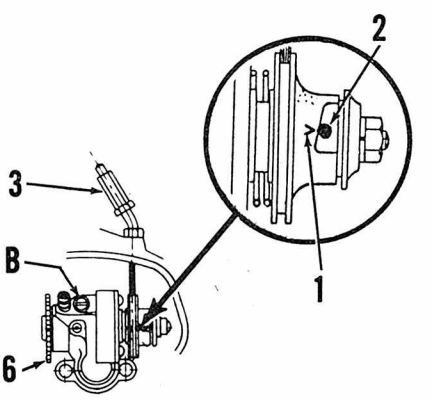


Fig. Y2-5—When carburetor controls are correctly adjusted and engine is at idle speed, "V" mark (1) should be aligned with guide pin (2). Cable adjuster is shown at (3).

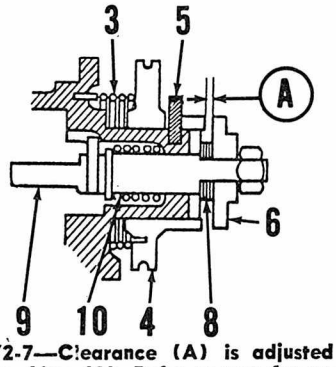


Fig. Y2-7—Clearance (A) is adjusted by varying shims (8). Refer to text for proper clearance.

can be used to indicate breaker point opening. If the timing marks on cam and plate (P) are correctly aligned, a power timing light can be used to check ignition timing.

LUBRICATION. The engine is lubricated by oil contained in a separate tank. A pump and metering unit pumps the oil from tank to each cylinder intake passage. The oil tank should never be allowed to run dry. SAE 30 two-stroke oil should be used. The oil pump control cable should be accurately adjusted to provide the correct amount of oil. If the cable adjustment is incorrect, the engine may be damaged.

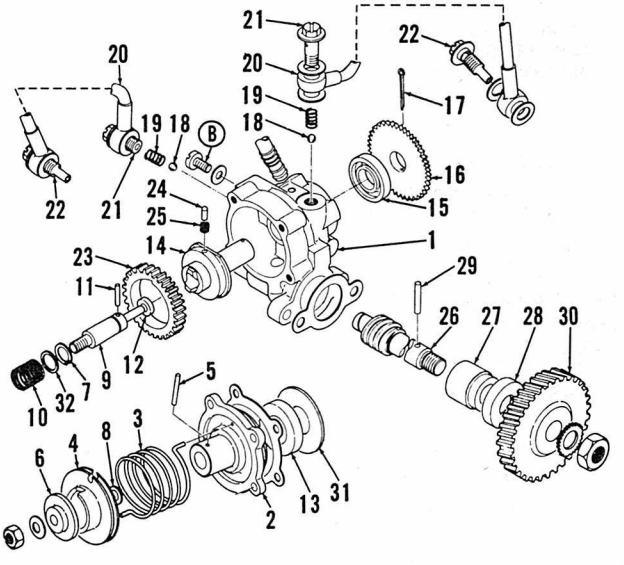
Before adjusting the pump control cable, it is important that the carburetor throttle cable guides (1—Fig. Y2-1) are correctly set. To adjust the throttle cable guides, turn idle speed adjusters (2) all the way down, then sychronize the cable guides (1) so that both throttle slides (7) begin to move at exactly the same time when the hand grip is turned. The throttle cables should have approximately $\frac{1}{16}$-inch free play at idle position after they are sychronized. Adjust idle speed to 1200-1500 RPM on YL-1 models and 1100-1200 RPM on HS-1 by turning both idle speed adjusters (2). Make sure that both throttle slides contact stops at the same time. Turn the throttle hand grip just enough to take up free play from the throttle cables (without changing idle speed) and check the oil pump setting mark and guide pin as shown in Fig. Y2-5. If the "V" mark (1) is not exactly aligned with the guide pin (2), loosen the lock nut and turn the pump cable adjuster (3) as required to align.

Check the minimum plunger stroke by turning starter plate (16—Fig. Y2-5) until clearance (A—Fig. Y2-7) between pulley and adjusting plate is at its minimum. Clearance (A) should be 0.25-0.35MM (0.0098-0.0138 inch) for 100cc models and 0.20-0.25 MM (0.0078-0.0098 inch) for 90cc models.) If clearance is incorrect, add or deduct shims (8).

If oil lines are drained or pump is removed, it is important that all lines

Fig. Y2-6—Exploded view of the oil injection pump unit.

1. Pump case
2. Cover
3. Pulley spring
4. Adjust pulley
5. Guide pin
6. Adjust plate
7. Snap ring
8. Shims
9. Plunger
10. Plunger return spring
11. Cam guide pin
12. Plunger oil seal
13. Plunger cam oil seal
14. Distributor
15. Oil seal
16. Starter plate
17. Drive pin
18. Check balls
19. Springs
20. Delivery pipes
21. Banjo bolts
22. Injector bolt
23. Worm wheel
24. Worm wheel pin
25. Spring
26. Worm shaft
27. Bushing
28. Oil seal
29. Pin
30. Drive gear
31. Worm wheel plate
32. Spring seat



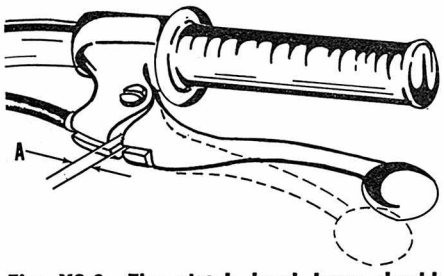


Fig. Y2-9—The clutch hand lever should have $\frac{1}{16}$-⅛ inch free play at (A).

be filled before starting engine. Remove bleeder screw (B—Fig. Y2-5) and pull the pump control cable up out of cable guide (3). Turn starter plate (16) until oil without air bubbles flows from the bleeder screw hole, then reinstall bleeder screw (B) and start engine. Run engine at idle speed until oil delivery lines (20—Fig. Y2-6) are free of air bubbles.

The gear box contains 1⅜ pints of SAE 30 motor oil and should be drained and refilled every 2000 miles.

CLUTCH CONTROLS. The clutch hand lever should have 0.08-0.12 inch free play at (A—Fig. Y2-9). To adjust, remove the rubber plug from engine left side cover and loosen lock nut. Turn the adjusting screw (S—Fig. Y2-10) in until slight resistance is felt, then back screw out ¼ turn and tighten lock nut. Turn the cable guide (G—Fig. Y2-11) until the hand lever free play (A—Fig. Y2-9) is correct.

SUSPENSION. The YL-1 front suspension unit contains 130cc of SAE 30

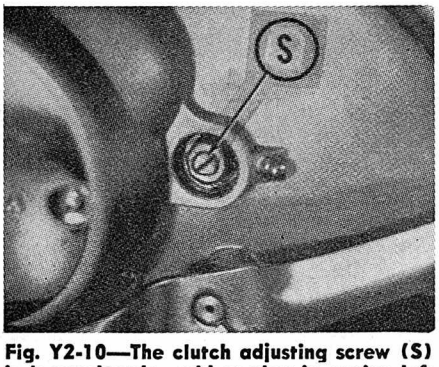


Fig. Y2-10—The clutch adjusting screw (S) is located under rubber plug in engine left side cover.

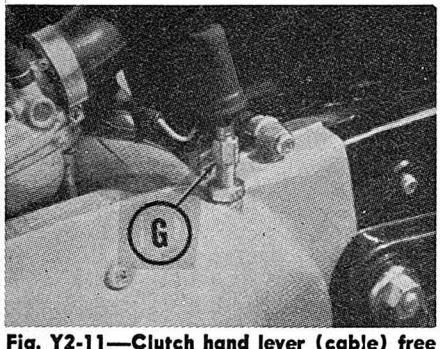


Fig. Y2-11—Clutch hand lever (cable) free play is adjusted by turning cable guide (G).

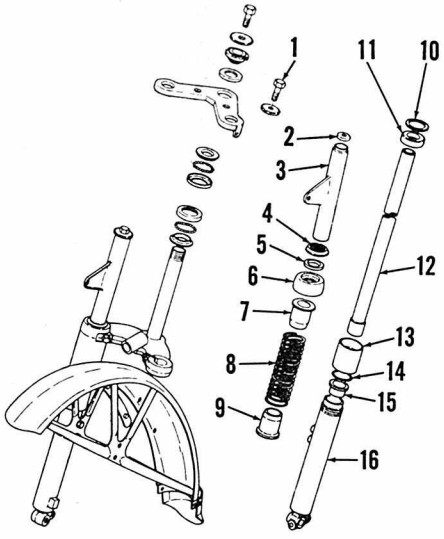


Fig. Y2-12—Exploded view of the front suspension system.

1. Filler screw
2. Seal
3. Cover
4. Guide
5. Gasket
6. Cover
7. Spring seat
8. Spring
9. Spring seat
10. Washer
11. Oil seal
12. Inner tube
13. Tube nut
14. "O" ring
15. Bushing
16. Lower tube

motor oil each. The HS-1 units contain 150cc of oil each. Oil in the front forks should be drained and filled with new oil every 4000 miles. Refer to Fig. Y2-12.

REPAIRS

PISTONS, RINGS AND CYLINDERS. Each piston can be removed after removing exhaust pipe, carburetor, cylinder head and cylinder. Refer to the following specifications:

Ring end gap .....0.006-0.013 inch
Ring groove clearance—
Top ring .....0.0016-0.0031 inch
Lower ring .....0.0012-0.0028 inch
Maximum cylinder bore taper or out of round .....0.002 inch
Piston skirt to cylinder clearance .....0.0013-0.0016 inch

Piston skirt clearance in cylinder bore should be measured by first measuring piston diameter at right angles to piston pin and cylinder bore diameter, then subtracting. The piston should be measured 10MM (0.4 inch) above bottom edge of skirt. The dark piston ring should be installed in lower groove and chrome plated ring should be in top groove. Make sure that rings correctly engage pins in the ring grooves. A Keystone type piston ring is used in the HS-1 models. See Fig. Y2-15A. Keystone rings cannot be interchanged with the standard type ring. The letter "K" stamped on piston indicates a Keystone type and the ring will be marked "1N" or "1T" for a top ring or "2N" or "2T" for a lower ring. Replacement pistons may be the Keystone type. Marks on all

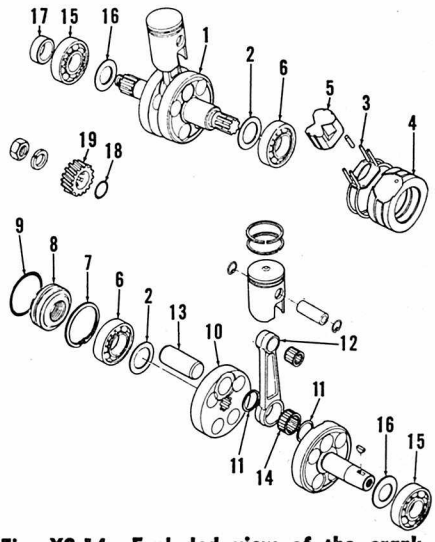


Fig. Y2-14—Exploded view of the crankshaft assembly.

1. Crankshaft right end
2. Shims
3. Gasket
4. Center housing
5. Filler
6. Center main bearings
7. Snap ring
8. Seal
9. "O" ring
10. Counter weight
11. Thrust washers
12. Connecting rod
13. Crankpin
14. Bearing
15. Main bearings
16. Shims
17. Oil seal collar
18. "O" ring
19. Crankshaft gear

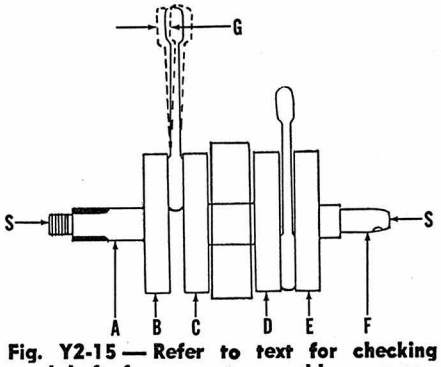


Fig. Y2-15 — Refer to text for checking crankshaft for correct assembly or wear.

rings are on the top side of ring. Pistons should be installed on connecting rods with arrow pointing toward front. Cylinder head stud nuts should be torqued to 90 inch-pounds.

CONNECTING RODS AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Connecting rods, crankpins, rod bearings and the center main bearings are removed by pressing the crankshaft apart. The crankshaft should be disassembled **ONLY** if required tools are available to correctly check and align the reassembled crankshaft. If side shake (G—Fig. Y2-15) at piston pin end of connecting rod end exceeds 0.08 inch (2MM), the connecting rod, crankpin and lower bearing should be renewed. Shake (G) should be 0.032-0.039 inch (0.8-1.0MM). Side clearance of connecting rod between the crankshaft counter weights can be measured with a feeler gage. Side clearance should be

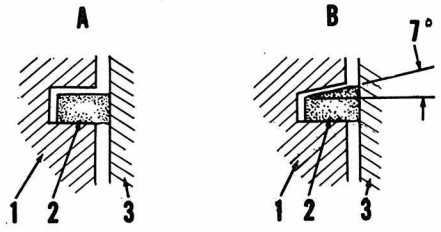


Fig. Y2-15A—Keystone type piston and ring assemblies (B) are used on later models.

1. Piston
2. Ring
3. Cylinder wall

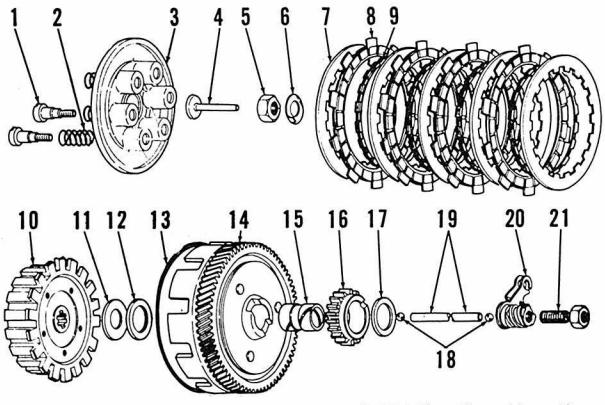


Fig. Y2-16 — Exploded view of the clutch assembly. Parts (20 & 21) are located in left cover.

1. Spring screws
2. Springs
3. Pressure plate
4. Release plunger
5. Nut
6. Lock plate
7. Driven plate (5 used)
8. Friction discs (4 used)
9. Separator rings (4 used)
10. Clutch hub
11. Thrust plate
12. Thrust bearing
13. Friction ring
14. Clutch drum
15. Bushing
16. Kick starter gear
17. Thrust plate
18. Balls
19. Release rod
20. Release screw
21. Adjusting screw

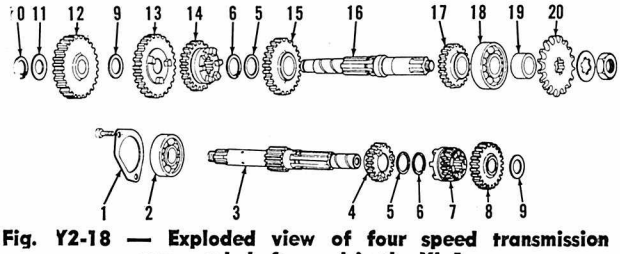


Fig. Y2-18 — Exploded view of four speed transmission gears and shafts used in the YL-1.

1. Bearing retainer
2. Bearing
3. Input shaft and first gear
4. Third gear
5. Thrust washers
6. Snap rings
7. Sliding gear (2nd)
8. Fourth gear
9. Shims
10. Snap ring
11. Thrust washer
12. Kick starter idler gear
13. First gear
14. Sliding gear (3rd)
15. Second gear
16. Output shaft
17. Fourth gear
18. Bearing
19. Seal collar
20. Output sprocket

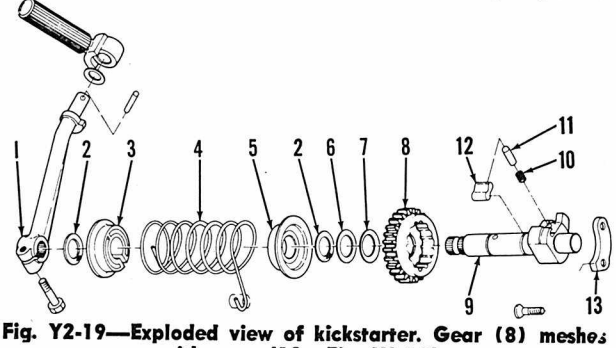
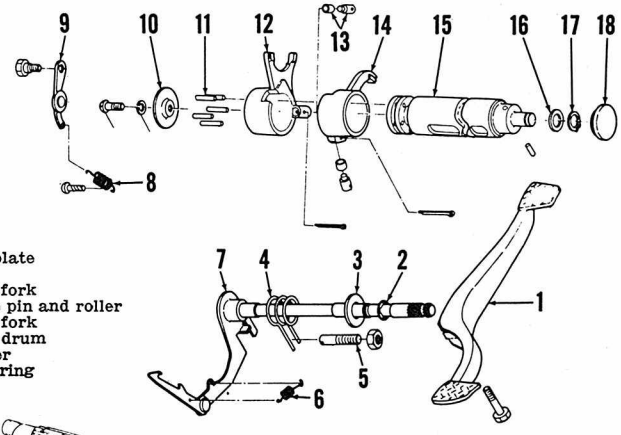


Fig. Y2-19—Exploded view of kickstarter. Gear (8) meshes with gear (12—Fig. Y2-18).

1. Pedal
2. Snap rings
3. Spring cover
4. Return spring
5. Spring guide
6. Shim
7. Wave washer
8. Kick starter gear
9. Starter shaft
10. Spring
11. Plunger
12. Ratchet
13. Stop plate

Fig. Y2-20 — Exploded view of gear shift assembly common to four speed models.

1. Change pedal
2. Snap ring
3. Washer
4. Return spring
5. Stop screw
6. Ratchet spring
7. Change shaft and arm
8. Detent spring
9. Detent pawl
10. Side plate
11. Pins
12. Shift fork
13. Guide pin and roller
14. Shift fork
15. Shift drum
16. Spacer
17. Snap ring
18. Plug



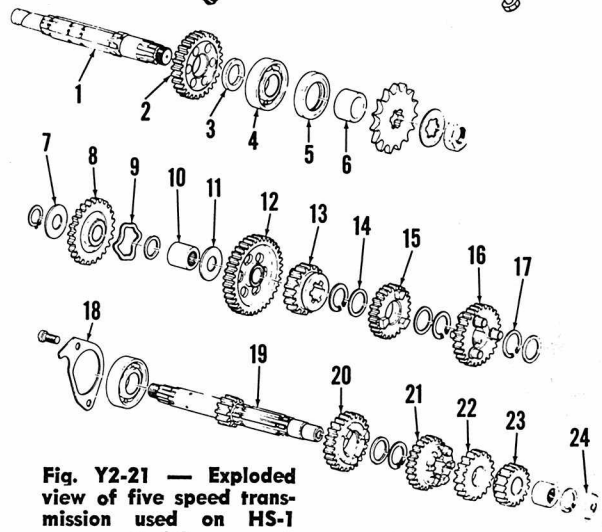


Fig. Y2-21 — Exploded view of five speed transmission used on HS-1 models.

1. Drive axle
2. Second gear wheel
3. Spacer
4. Ball bearing
5. Oil seal
6. Distance collar
7. Drive axle shim
8. Kick idle gear
9. Wave washer
10. Needle bearing
11. Drive axle shim
12. First gear wheel
13. Fifth gear wheel
14. Gear hold washer
15. Fourth gear wheel
16. Third gear wheel
17. Snap ring
18. Bearing cover plate
19. Main axle
20. Fifth pinion gear
21. Fourth pinion gear
22. Third pinion gear
23. Second pinion gear
24. Push rod seal

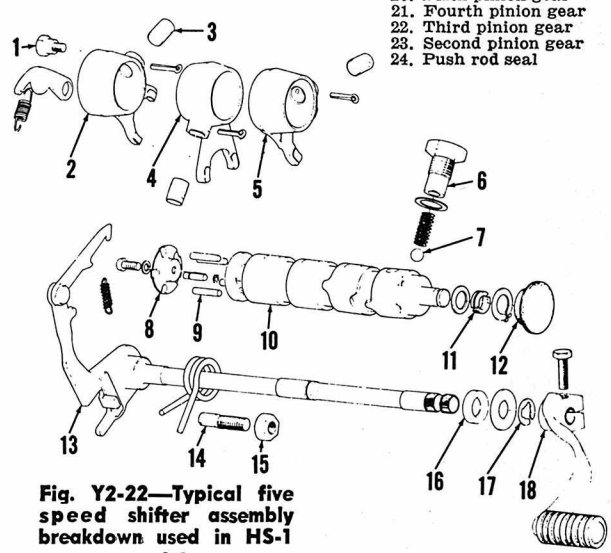


Fig. Y2-22—Typical five speed shifter assembly breakdown used in HS-1 models.

1. Stopper bolt
2. Third shift fork
3. Cam follower pin
4. Second shift fork
5. First shift fork
6. Neutral spring holding bolt
7. Neutral detent ball
8. Side plate
9. Locating pin
10. Shifting cam
11. Shifting cam holders
12. Blind plug
13. Change shaft assembly
14. Eccentric screw
15. Lock nut
16. Oil seal
17. Snap ring
18. Change lever

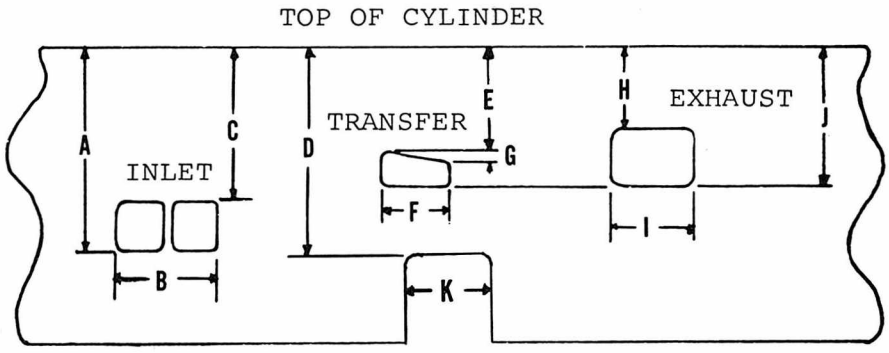


Fig. YT2-1—Diagram of cylinder porting used on YL-1 Yamaha. Refer to text for dimensions.

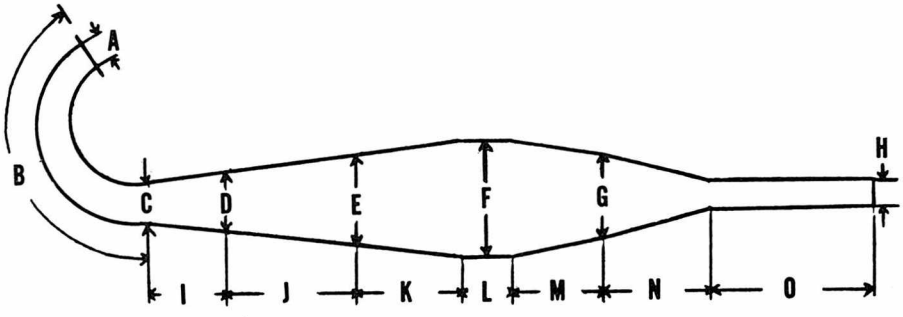


Fig. YT2-2—An expansion chamber constructed to this set of specifications will produce a high RPM (peaky) performing engine.

0.0039-0.012 inch (0.1-0.3MM). With crankshaft supported between lathe centers (S—Fig. Y2-15), maximum eccentricity when measured with dial indicator at points (A, B, C, D, E, & F) should not exceed 0.0008 inch.

CLUTCH. The multiple disc, wet type clutch is located on the right end of the transmission input shaft. To remove the clutch it is necessary to first remove the engine right side cover.

Clutch friction discs (8—Fig. Y2-16) are 0.158 inch (4MM) thick and should be renewed if less than 0.153 inch thick. Free length of springs (2) is 1 inch when new for YL-1 models and 1.24 inches on HS-1 models. Springs should be renewed if free length is less than 0.925 inch on YL-1 and 1.20 inch on HS-1. Inspect all parts for wear, warpage and evidence of overheating.

CRANKCASE AND GEAR BOX. The crankshaft and transmission parts can be removed after the crankcase halves are separated.

To separate the crankcase halves, it is necessary to remove the engine from the frame. Remove cylinders, pistons, engine side covers, generator assembly, clutch assembly, crankshaft (primary drive) gear, kickstarter (including the idler gear) and the shift shaft and linkage. Remove the screws that attach the halves together and carefully separate the halves. The gears and shafts should stay in place in the crankcase left half. Refer to Figs. Y2-18, Y2-19 and Y2-20.

SPEED TUNING

A "GYT" kit is available for the YL-1 (100 Twin Jet). A YL-1 "GYT" kit will fit on HS-1 (90 twin) models and change displacement to 100cc. Many features in the YL-1 "GYT" kit may be machined into standard YL-1 parts. The following specifications may improve performance in Yamaha 100cc twins. Any modification of standard parts or installation of performance parts will void the manufacturers warranty.

SPARK PLUG. An NGK type B-10EN or B-11EN should be used and shimmed with extra plug washers for correct fit.

CARBURETOR. Standard YL-1 carburetor should be used and intake port diameter should be carefully matched to carburetor bore diameter.

IGNITION. Armature may be turned down to bare shaft and total loss ignition used or a specially constructed magneto is available. All unused wiring should be removed.

LUBRICATION. Oil metering pump should be removed and hole plugged to prevent loss of transmission lubricant. Use a 15:1 or 16:1 fuel to oil mixture in fuel tank. Only oils intended for use in two stroke air cooled engines should be used. Make certain that oil feed holes in cylinders are also plugged.

CYLINDER, PISTON AND HEAD. Cylinder head should be milled 0.060 inch. Make certain that 20 degree taper is remachined in edge of combustion chamber.

Piston skirt should be shortened by 5 MM (0.196 inch) and only top piston ring should be used. Height of piston after modification should be 46.5 MM (1.83 inches) when measured along the side.

Modify 100cc cylinders to the following specifications:

(See Fig. YT2-1)

A. 68 MM (2.677 in.)
B. 27 MM (1.063 in.)
C. 47 MM (1.850 in.)
E. 34 MM (1.338 in.)
H. 24 MM (0.945 in.)
I. 25 MM (0.984 in.)

Dimensions not shown are left standard.

EXPANSION CHAMBER. A high RPM expansion chamber may be constructed using the following specifications:

(See YT2-2)

A. 31.5 MM (1.239 in.)
B. 226 MM (8.987 in.)
C. 40 MM (1.574 in.)
D. 50 MM (1.968 in.)
E. 66 MM (2.598 in.)
F. 87 MM (3.425 in.)
G. 62 MM (2.440 in.)
H. 20 MM (0.787 in.)
I. 60 MM (2.362 in.)
J. 95 MM (3.740 in.)
K. 80 MM (3.149 in.)
L. 40 MM (1.574 in.)
M. 70 MM (2.755 in.)
N. 90 MM (3.149 in.)
O. 150 MM (5.905 in.)

YAMAHA YL-2, L5T AND YA-6 SINGLE CYLINDER MODELS

MODEL	YL-2 & YL-2C	YA-6	L5T
Displacement-cc	97	123	97
Bore-MM	52	56	52
Stroke-MM	45.6	50	45.6
Number of cylinders	1	1	1
Engine oiling system		"Autolube"	
Plug gap-inch	0.024-0.028		0.020-0.024
Point gap-inch		0.012-0.014	
Ignition timing	*	Automatic Advance	
Piston position BTDC-inch	**0.071	**0.100	**0.071
Electrical system voltage	12	12	12
Battery terminal grounded	Negative	Negative	Negative
Tire size-front	+2.50x18	3.00x16	2.75x17
Rear	+2.50x18	3.00x16	3.00x17
Tire pressure-front	24-26	22	20
Rear	26-28	28	28
Rear chain free play-inch	⅝-⅞	⅝-⅞	¾-1
Number of speeds	4	4	§3x2
Weight-lbs. (approx.)	++200	264	198

*On YL-2, ignition timing is fixed. On YL-2C, ignition timing is automatically advanced.
**Ignition timing for YL-2C, L5T and YA-6 is full advance (weights fully extended).
+Tire size for YL-2C models is 3.00x18
++Weight for YL-2C models is 205 lbs.
§Transmission in the L5T is equipped with a high and low selector to make in effect a six speed transmission.

MAINTENANCE

SPARK PLUG. Recommended spark plug electrode gap is 0.024-0.028 inch (0.6-0.7MM) for all models except L5T which should be set at 0.020-0.024 inch (0.5-0.6 MM). Recommended spark plug for normal use is NGK type B8HC for 100cc models, B7HZ for 125cc models. Champion type L-81 or L-85 can be used.

CARBURETOR. A Mikuni VM carburetor is used. Idle speed is changed by turning adjuster (2—Fig. Y3-1). Idle mixture is adjusted by turning needle (11). Float setting (H—Fig. Y3-2) should be ⅞ inch (22MM) for 100cc models, 0.984 inch (25MM) for 125cc models. Refer to Fig. Y3-1 and the following specifications:

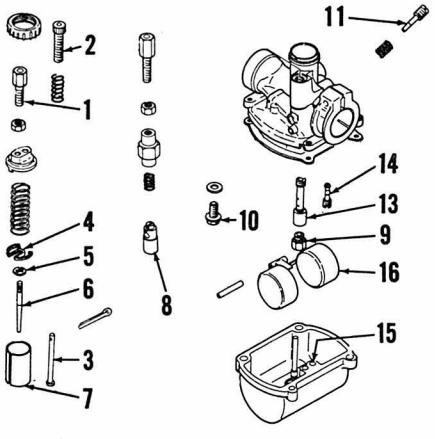


Fig. Y3-1—Exploded view of typical Mikuni carburetor.

1. Throttle cable guide
2. Idle speed adjuster
3. Idle speed rod
4. Retainer
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Fuel inlet valve
11. Idle mixture needle
13. Needle jet
14. Pilot jet
15. Starting jet
16. Float

YL-2

Main jet (9) ..... #120
Pilot jet (14) ..... #20
Starter jet (15) ..... #40
Needle jet (13) D-0
Valve needle (6) 3D3
Clip (5) in third groove from top of needle (6).
Idle mixture needle (11) initial setting is 1½ turns open.

YL-2C

Main jet (9) ..... #95
Pilot jet (14) ..... #30
Starter jet (15) ..... #40
Needle jet (13) N-8
Valve needle (6) 4D2
Clip (5) in third groove from top of needle (6).
Idle mixture needle (11) initial setting is 1¾ turns open.

Some YL2-C carburetors have been modified to improve transitional performance from low to high RPM. Standard needle jet (13) is drilled lengthwise with a #36 drill and air holes in side of needle jet drilled out with a #60 drill. Small brass plug at bottom center of throttle bore opening (air bleed plug) is center punched and drilled out with a #60 drill. Main jet should be a #130 or #140 long type.

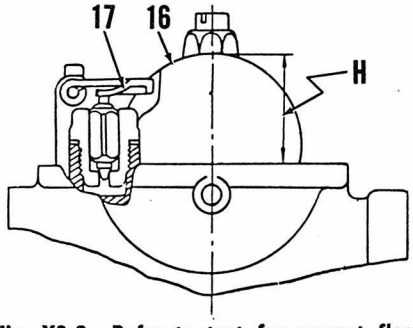


Fig. Y3-2—Refer to text for correct float height (H). Height is changed by bending tang (17).

YA-6

Main jet (9) ..... #190
Pilot jet (14) ..... #30
Starter jet (15) ..... #110
Needle jet (13) 0-0
Valve needle (6) 4J6
Clip (5) in third groove from top of needle (6).
Idle mixture needle (11) initial setting is 1½ turns open.

L5T

Main jet (9) ..... #180
Pilot jet (14) ..... #20
Starter jet (15) ..... #40
Needle jet (13) 0-8
Valve needle (6) 4D2
Clip (5) in third groove from top of needle (6).
Idle mixture needle (11) initial setting is ¾-turn open.

IGNITION AND ELECTRICAL. The generator and battery ignition system breaker points are located on the left end of crankshaft on YL-2 models. Models YL-2C, YA-6 and L5T are equipped with a combination starter-generator unit similarly mounted. Models with electric starter are provided with a centrifugal (automatic) ignition advance; while ignition timing is fixed and does not change on YL-2 models without electric starter.

Ignition breaker point gap should be 0.012-0.014 inch. Ignition timing should occur (breaker point just open)

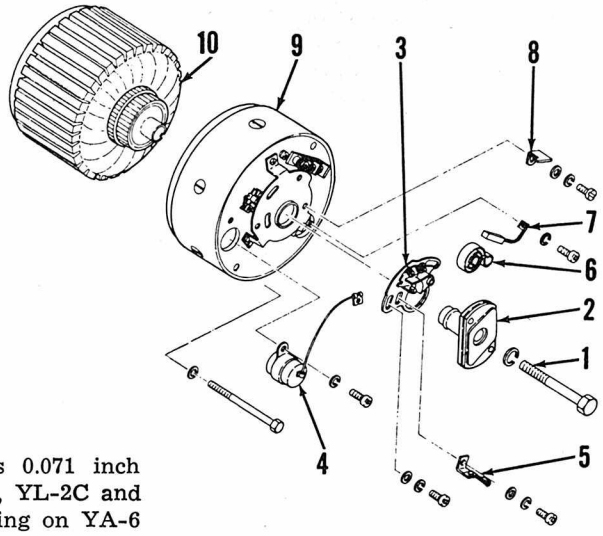


Fig. Y3-4—Exploded view of starter-generator used on YL-2C and L5T models. The unit used on YA-6 is similar. The generator used on YL-2 models is similar except ignition cam (2) does not have advance mechanism.

1. Retaining screw
2. Cam and advance unit
3. Breaker points
4. Condenser
5. Lubricator
6. Brush spring
7. Brush
8. Timing plate
9. Field and stator
10. Armature

when the piston reaches 0.071 inch (1.8MM) BTDC on YL-2, YL-2C and L5T models. Ignition timing on YA-6 models should occur when piston is 0.100 inch (2.4MM) BTDC. When checking ignition timing on electric starter models, make certain that the centrifugal advance weights are completely extended (out) in the fully advanced position.

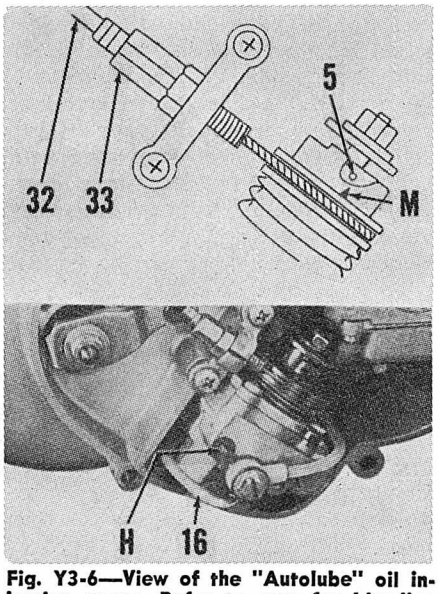


Fig. Y3-6—View of the "Autolube" oil injection pump. Refer to text for bleeding and adjusting procedure.

H. Bleeding hole
M. Mark
5. Guide pin
16. Starter plate
32. Pump control cable
33. Cable guide

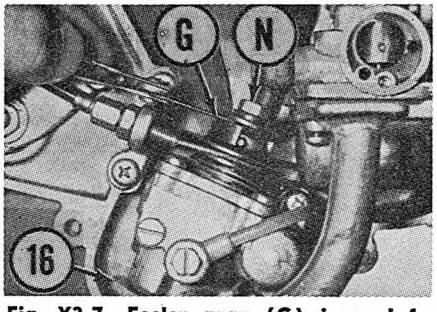


Fig. Y3-7—Feeler gage (G) is used for checking the minimum plunger stroke. Shims can be added or subtracted after removing nut (N) and adjusting plate. Refer to text.

LUBRICATION. The engine is lubricated by oil contained in a separate tank which is pumped into the inlet passage in the rotary valve cover plate. For use above 20°F., SAE 30 two-stroke oil is recommended. For temperatures below 20°F., SAE 10W/30 oil should be used. The oil tank should **never** be allowed to run dry.

The automatic metering system varies the oil ratio depending upon throttle setting. The oil pump and metering unit is located under the right side (carburetor) cover.

If the "Autolube" system is drained or the pump unit is renewed, the air should be bled from the system as follows: Remove screw from bleeder hole (H—Fig. Y3-6), pull pump control cable (32) up out of the guide (33) and turn starter plate (16) until oil without air bubbles flows from hole (H). Reinstall the bleeder bolt. Start engine and run at idle speed while pulling pump cable (32) up until oil lines are completely free of air bubbles. If bubbles can not be removed from the pressure line, check for leaking pump seals or inlet oil line.

The pump must be correctly adjusted to provide the correct amount of oil for proper lubrication. Adjustment should be checked every 2,000 miles. To adjust, proceed as follows: Check the plunger minimum stroke by turning the starter plate (16—Fig. Y3-7) until clearance between pulley and adjusting plate is at its minimum, then measure clearance with a feeler gage as shown at (G). If clearance is not within limits of 0.008-0.010 inch (0.20-0.25 MM), vary the number of shims (8—Fig. Y3-8). After plunger minimum stroke is correctly set, twist the throttle until top of "O" mark stamped on carburetor slide is at top of carburetor bore and check alignment mark (M—Fig. Y3-6). Mark (M) should be exactly aligned with guide pin (5). If not aligned, loosen the lock nut and turn cable guide (33) until mark is aligned with guide pin.

Yamaha Gear Oil or SAE 20W/40 engine oil should be used in the gear box on all models. Capacity is approximately ¾ quart for YL-2, YL-2C and L5T models; 1½ quarts for YA-6.

CLUTCH CONTROLS. The clutch hand lever should have $\frac{1}{16}$-⅛ inch (2-3MM) free play at (A—Fig. Y3-10). To adjust, remove the rubber plug from engine left side cover on YA-6 models or the carburetor (right side) cover on YL-2, YL-2C and L5T models. Loosen the lock nut and turn the adjusting screw (under the rubber

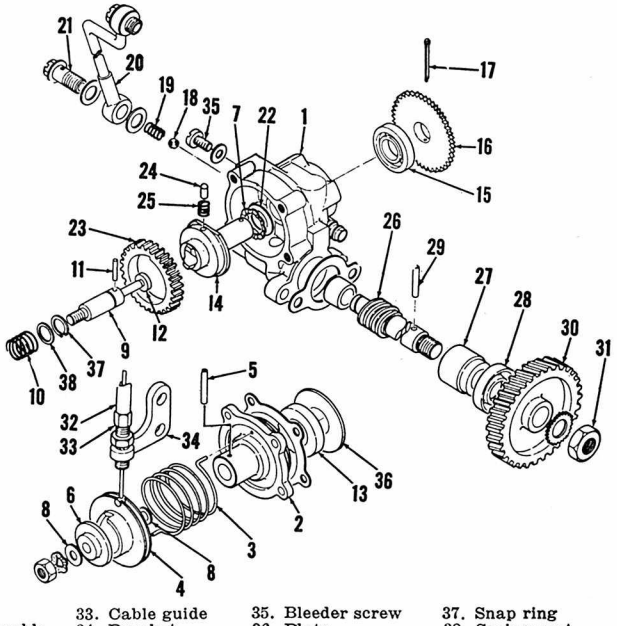


Fig. Y3-8—Exploded view of the "Autolube" oil injection pump.

1. Pump body
2. Cover
3. Pulley spring
4. Pulley
5. Guide pin
6. Adjust plate
7. Wave washer
8. Shims
9. Plunger
10. Plunger return spring
11. Plunger pin
12. Plunger oil seal
13. Plunger cam oil seal
14. Distributor
15. Distributor oil seal
16. Starter plate
17. Drive pin
18. Check ball
19. Check valve spring
20. Delivery pipe
21. Banjo bolts
22. Thrust plate
23. Worm wheel
24. Worm wheel pin
25. Spring
26. Worm shaft
27. Worm shaft bushing
28. Oil seal
29. Pin
30. Drive gear
31. Nut
32. Control cable
33. Cable guide
34. Bracket
35. Bleeder screw
36. Plate
37. Snap ring
38. Spring seat

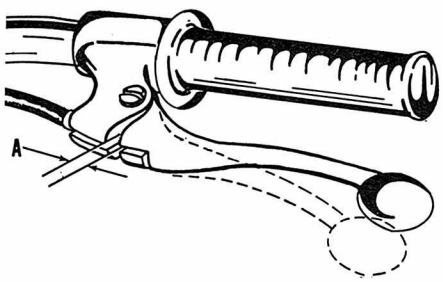


Fig. Y3-10—The clutch should be adjusted to provide $\frac{1}{16}$-$\frac{1}{8}$-inch free play at (A).

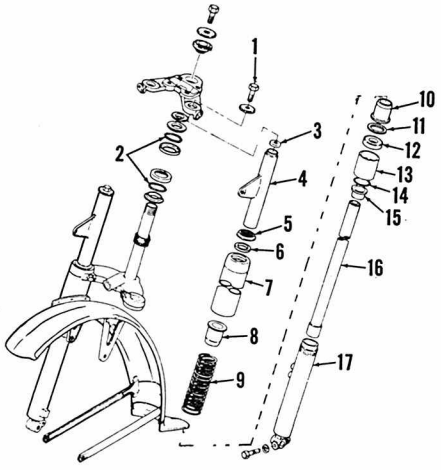


Fig. Y3-12—Exploded view of the front suspension used on YL-2 models. Other models are similar.

1. Filler screw
2. Bearing balls
3. Gasket
4. Cover
5. Washer
6. Gasket
7. Cover
8. Spring seat
9. Spring
10. Spring seat
11. Washer
12. Oil seal
13. Nut
14. "O" ring
15. Bushing
16. Inner tube
17. Lower tube

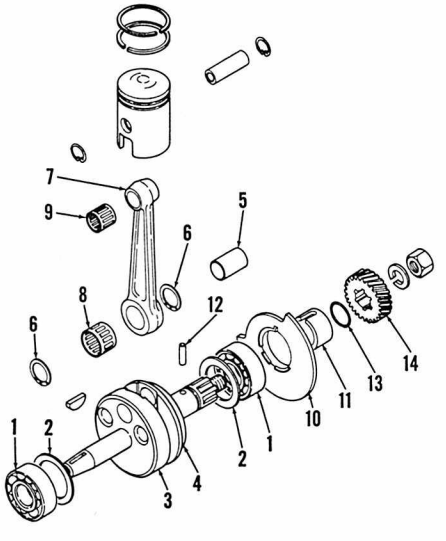


Fig. Y3-14—Exploded view of the crankshaft used on 100cc models. Other models are similar.

1. Main bearings
2. Shims
3. Crankshaft left end
4. Crankshaft right end
5. Crankpin
6. Thrust washers
7. Connecting rod
8. Lower bearing
9. Piston pin bearing
10. Rotary valve disc
11. Valve collar
12. Valve drive pin
13. "O" ring
14. Crankshaft primary drive gear

plug) until slight resistance is felt, then back the screw out ¼ turn and tighten lock nut. Adjust the cable guide to provide the correct amount of free play at (A—Fig. Y3-10).

SUSPENSION. Each front suspension unit contains 145cc of oil on YL-2 and YL-2C models; 165-175cc of oil on YA-6 models; 140cc of oil on L5T models. Oil used should be a mixture of 8 parts SAE 30 motor oil and 2 parts of SAE 60 spindle oil. Oil should be drained every 4,000 miles and new oil filled through hole for screw (1—Fig. Y3-12). Nineteen bearing balls (2) are used in each race.

REPAIRS

PISTON, RINGS AND CYLINDER. The piston can be removed after removing the exhaust pipe, cylinder head and cylinder. Standard cylinder bore diameter is 52MM (2.05 inches) for 100cc models; 56MM (2.20 inches) for 125cc models. Refer to the following specification data:

YL-2 and YL-2C

Ring end gap—
Both rings .....0.15-0.35MM (0.006-0.014 in.)
Ring side clearance in groove—
Top .....0.04-0.08MM (0.0016-0.0032 in.)
Second .....0.03-0.07MM (0.0012-0.0028 in.)
Piston skirt to cylinder clearance .....0.025-0.030MM (0.0010-0.0012 in.)
Taper or out of round limit .....0.05MM (0.002 in.)

L5T

Ring end gap—
both rings ..... 0.15-0.50MM (0.006-0.019 in.)
Ring side clearance in groove—
both rings .....0.04-0.08MM (0.0016-0.003 in.)
Piston skirt to cylinder clearance ... 0.40-0.45 MM (0.016-0.017 in.)
Taper or out of round limit .... 0.05 MM (0.002 in.)

YA-6

Ring end gap—
Top .....0.15-0.30MM (0.006-0.012 in.)
Second .....0.10-0.20MM (0.004-0.008 in.)
Piston skirt to cylinder clearance .....0.03-0.04MM (0.0012-0.0016 in.)
Taper or out of round limit .....0.05MM (0.002 in.)

Piston skirt to cylinder clearance should be measured by first measuring piston diameter 10MM (0.4 inch) from bottom of piston at right angles to piston pin and cylinder bore diameter, then subtracting. If cylinder is bored for oversize piston and rings, edges of all ports should be rounded slightly to prevent ring from catching. Chrome plated piston ring should be installed in top groove and dark colored ring in second groove. Rings should be installed with marks on side toward the top of piston. Piston must be installed with arrow on top aimed toward front. The cylinder head retaining stud nuts should be torqued evenly to 180 inch-pounds.

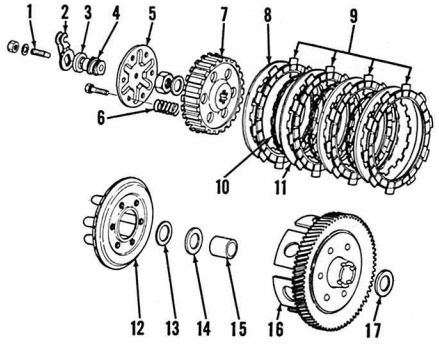


Fig. Y3-16—Exploded view of clutch used on 100cc models. Refer to Fig. Y3-17 for 125cc models.

1. Adjusting screw
2. Clutch lever
3. Oil seal
4. Release screw
5. Spring plate
6. Spring
7. Clutch hub
8. Clutch plate (thick)
9. Friction discs (4 used)
10. Separator rings (4 used)
11. Clutch plates (3 used)
12. Pressure plate
13. Thrust washer
14. Thrust bearing
15. Spacer
16. Clutch drum
17. Thrust washer

CONNECTING ROD AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Connecting rod, crankpin and roller bearing are removed by pressing crankshaft apart. Crankshaft should be disassembled **only** if required tools are available to correctly check and align the reassembled crankshaft. If the connecting rod side shake at piston pin end exceeds 2MM (0.079 inch) on 100cc models or 3MM (0.118 inch) on 125cc models, the connecting rod crankpin and lower end bearing should be renewed. The crankshaft eccentricity should be less than 0.03MM (0.0012 inch) when measured at main bearing journals with crankshaft supported between lathe centers.

CLUTCH. Refer to Fig. Y3-16 for clutch used on 100cc models or Fig. Y3-17 for clutch used on 125cc models. The clutch is mounted on the right end of the transmission input shaft on all models.

Standard thickness of friction discs (9—Fig. Y3-16 or Y3-17) is 0.138 inch (3.5MM) for 100cc models, 0.157 inch (4.0MM) for 125cc models. Friction

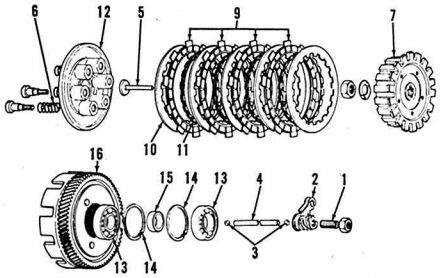


Fig. Y3-17—Exploded view of clutch used on YA-6 models.

1. Adjusting screw
2. Release lever
3. Balls
4. Release rod
5. Release plunger
6. Springs
7. Clutch hub
9. Friction discs (4 used)
10. Clutch plates (5 used)
11. Separator rings (4 used)
12. Pressure plate
13. Bearings
14. Snap rings
15. Spacer
16. Clutch drum

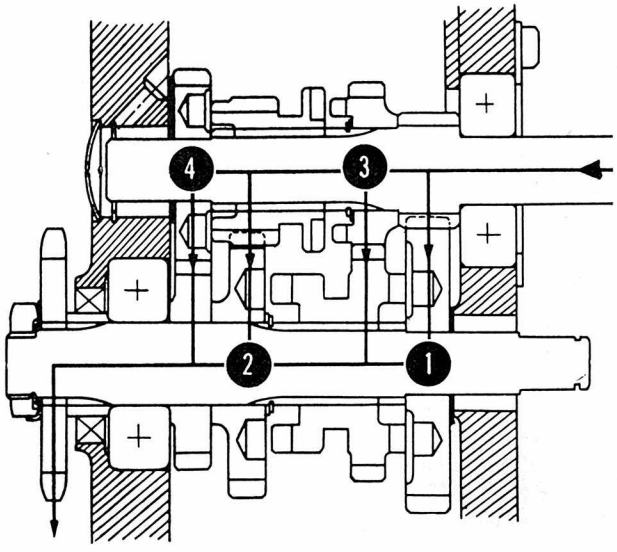


Fig. Y3-19 — Cross sectional drawing of the transmission used on YL-2 and YL-2C models.

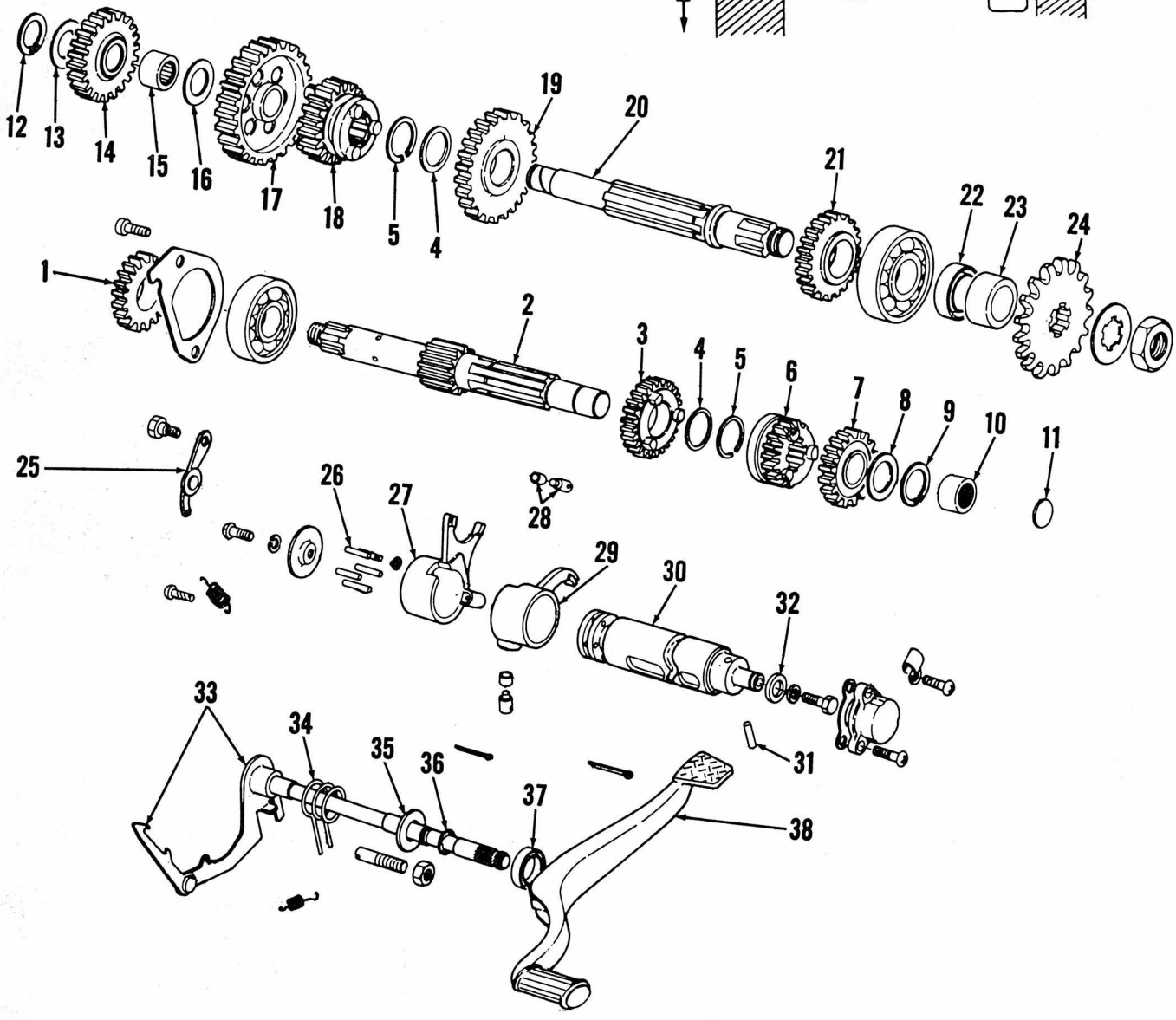


Fig. Y3-18—Exploded view of transmission used on YL-2 and YL-2C models. Refer to Fig. Y3-19 for cross sectional view.

1. Kick starter gear
2. Input shaft and first gear
3. Third gear
4. Washers
5. Snap rings
6. Sliding gear (2nd)
7. Fourth gear
8. Shims
9. Snap ring
10. Bearing
11. Plug
12. Snap ring
13. Thrust washer
14. Kick starter idler gear
15. Bearing
16. Shims
17. First gear
18. Sliding gear (3rd)
19. Second gear
20. Output shaft
21. Fourth gear
22. Oil seal
23. Collar
24. Output sprocket
25. Detent
26. Shift pins
27. Shift fork
28. Guide pin and roller
29. Shift fork
30. Shift drum
31. Dowel pin
32. Washer
33. Shift arm and shaft
34. Return spring
35. Washer
36. Snap ring
37. Oil seal
38. Change pedal

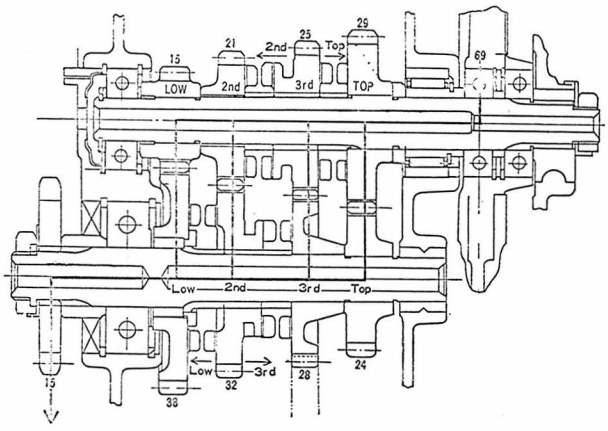


Fig. Y3-20 — Cross sectional view of YA-6 four speed transmission. Number above or below gears is number of teeth on that gear.

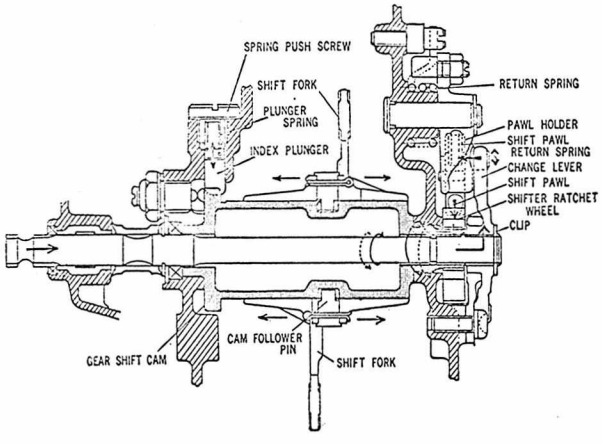


Fig. Y3-21 — Cross sectional view of gear shift mechanism used on YA-6.

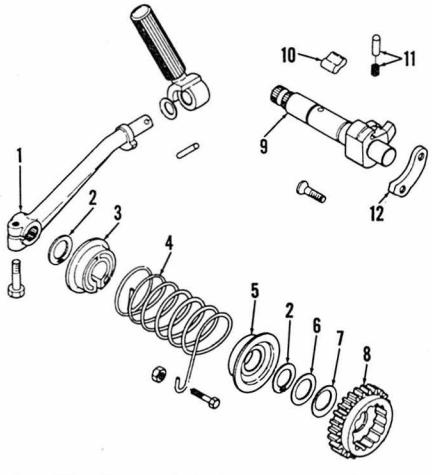


Fig. Y3-22—Exploded view of YL-2 and YL-2C kick starter. Gear (8) meshes with idler gear (14—Fig. Y3-18).

1. Kick starter pedal
2. Snap rings
3. Spring cover
4. Return spring
5. Spring guide
6. Shim
7. Spring washer
8. Kick starter gear
9. Shaft and pawl holder
10. Pawl
11. Pawl plunger and spring
12. Pawl stop

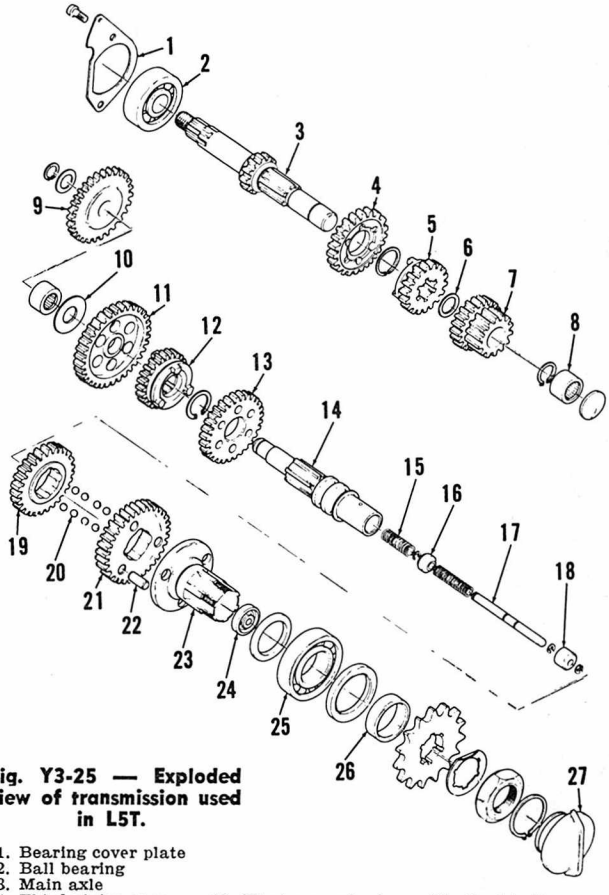


Fig. Y3-25 — Exploded view of transmission used in L5T.

1. Bearing cover plate
2. Ball bearing
3. Main axle
4. Third pinion gear
5. Second pinion gear
6. Shim
7. Pinion assembly
8. Needle bearing
9. Kick idle gear
10. Drive axle shim
11. First gear wheel
12. First gear wheel
13. Second gear wheel
14. Counter axle
15. Shift spring
16. Shifter head
17. Shifter rod
18. Shifter collar
19. Drive gear #1
20. Steel ball
21. Drive gear #2
22. Gear drive pin
23. Drive axle
24. Shift rod oil seal
25. Ball bearing
26. Distance collar
27. Shifter knob

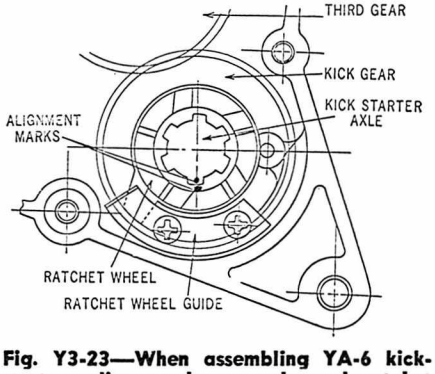


Fig. Y3-23—When assembling YA-6 kick-starter, align marks on axle and ratchet wheel as shown.

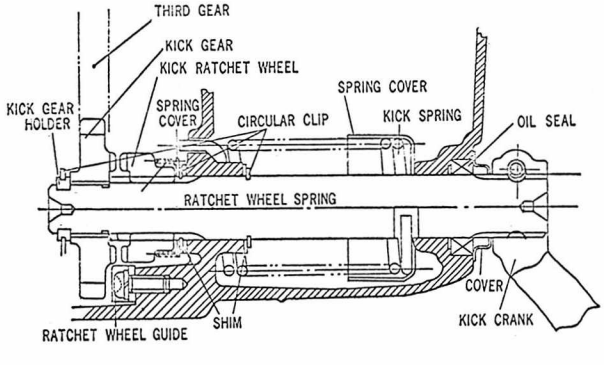


Fig. Y3-24 — Cross sectional view of YA-6 kick-starter.

discs less than 0.126 inch (3.2MM) thick on 100cc models or 0.146 inch (3.7MM) thick on 125cc models should be renewed. Free length of new clutch spring on 100cc models is 28.2 MM (1.14 inch). On YA-6 free length of new clutch spring is 31.5 MM (1.24 inch). On YL-2 and YL-2C models, clutch springs should be renewed if free length is more than 0.08 inch (2MM) shorter than new spring. On YA-6 models, springs should be renewed if free length is more than 0.12 inch (3MM) shorter than new spring. On L5T models, clutch spring should be renewed if free length is more

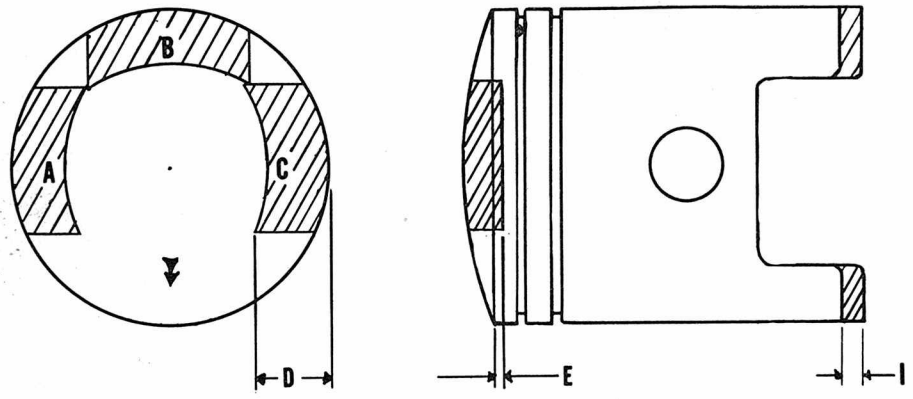


Fig. YT3-1—Areas of piston to be modified. Cuts (A, B & C) should only be as wide as transfer ports and extend 10 MM across top of pistons. Cuts should be 2 MM deep at edge of piston and taper to zero at end of cut.

than 0.04 inch (1MM) shorter than new spring.

Be sure that separator rings (11—Fig. Y3-16 or Y3-17) are not twisted when installed.

CRANKCASE AND GEAR BOX. The crankcase halves can be separated after removing the engine from the frame. Remove the piston, clutch and rotary valve assembly. The rotary valve is located on the right end of the crankshaft with a roll pin. Care should be taken to prevent valve disc from becoming too dry or absorbing water. After valve is washed with solvent, be sure to wipe with oil to prevent complete drying out. Remove the generator and ignition assembly, output sprocket and shift linkage. On YL-2 and YL-2C models, remove the kick starter idler gear from right end of output shaft. On all models, remove screws attaching crankcase halves together, then carefully separate the halves. Refer to Figs. Y3-18 and Y3-19.

The L5T is equipped with a 3 speed high and low range transmission. A lever on the left side of the case changes the gear ratio to high or low. See Fig. Y 3-25 for breakdown. The primary shifting linkage is very similar to the YL-2 models.

SPEED TUNING

A "GYT" kit is offered for YL-2 and YL-2C models. Many features of the kit may be incorporated in standard parts. The following modifications may improve performance of these 100cc rotary valve singles. Any modification of standard parts or installation of performance parts will void the manufacturers warranty.

CARBURETOR: Use of a VM22 SC is recommended with the following specifications:

Main jet ..... #160
Jet needle ..... 4 J 6
Needle jet 0-0

Jet needle clip in second groove from top of needle.

Intake bellmouth of carburetor should be shortened by 9 MM (0.35 inch) for better breathing.

CYLINDER, PISTON AND HEAD. Milling of the head is not recommended.

Remove 2 MM (0.078 inch) from top of exhaust port in cylinder liner.

Remove 7 MM (0.275 inch) from piston skirt all the way around piston (I-Fig. YT3-1) and remove 2 MM (0.078 inch) from areas (A, B & C) adjacent to transfer ports. Cuts (A, B & C) in top of piston should be 2MM deep at edge (E) and taper to nothing in length (D) 10MM. Cuts should only be as wide as transfer ports in cylinder. Use only top (chrome) piston ring.

YAMAHA 125, 180 AND 200 CC TWO CYLINDER MODELS

MODEL	YCS1 & YCS1-C	YAS1 & YAS1-C	AS2C	CS3B CS3C
Displacement-cc	180	124	124	195
Bore-MM	50	43	43	52
Stroke-MM	46	43	43	46
Number of cylinders	2	2	2	2
Engine oiling system	Oil Injection			
Plug gap-inch	0.020-0.023	0.020-0.023	0.020-0.023	0.020-0.023
Point gap-inch	0.012-0.014	0.012-0.014	0.012-0.014	0.012-0.016
Ignition timing	Automatic-Advance	Automatic Advance	Automatic-Advance	Automatic-Advance
Piston position BTDC-full advance	0.070 inch	0.070 inch	0.070 inch	0.070 inch
Electrical system voltage	12	12	12	12
Battery terminal grounded	Negative	Negative	Negative	Negative
Tire size-front	2.50x18	2.50x18	2.75x18	2.75x18
Rear	2.75x18	2.75x18	3.00x18	3.00x18
Tire pressure-front	22	22	22	24
Rear	*26	26	26	28
Rear chain free play-inch	½-⅝	½-⅝	¾	¾
Number of speeds	5	5	5	5
Weight-lbs. (approx.)	262	216	220	262

*Increase rear tire pressure to 28 psi when carrying passenger.

MAINTENANCE

SPARK PLUGS. Recommended spark plug electrode gap is 0.020-0.023 inch. Recommended spark plug is NGK type B-9HC for YAS1-C and AS2C models; NGK type B-7HZ for CS3B and CS3C models; B-8HC for other models.

CARBURETOR. Two Mikuni VM carburetors are used. Idle speed should be set to 1,100-1,300 RPM by turning screws (2A—Fig. Y4-1) or adjusters (2C). Make sure that both stop at exactly the same position and exhaust pressure is the same for both cylinders. Idle mixture is changed by turning needles (11). Initial setting is 1¾-2 turns open. Turning the needle counter-clockwise leans the mixture. Carburetors must be synchronized to open exactly the same amount by turning cable guides (1) on top of

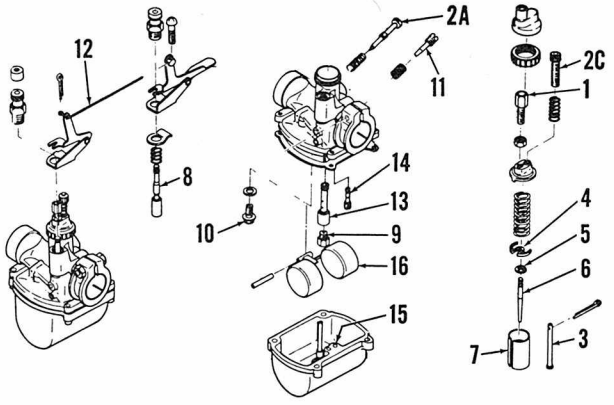


Fig. Y4-1—Exploded view of Mikuni VM carburetor. Starting valves for both carburetors are connected with rod (12).

1. Throttle cable guide
2A. Idle speed screw
2C. Idle speed adjuster
3. Idle speed rod
4. Retainer
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Fuel inlet valve
11. Idle mixture needle
12. Link rod
13. Needle jet
14. Pilot jet
15. Starting jet
16. Float

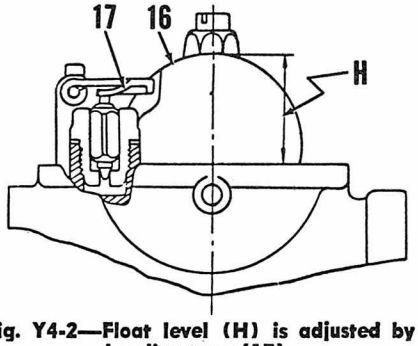


Fig. Y4-2—Float level (H) is adjusted by bending tang (17).

each carburetor. To synchronize, begin by turning both idle speed screws (2A) out or idle speed adjusters (2C) all the way down. Adjust cable guides (1) to begin raising both throttle slides at the same time. Throttle cables must have some slack (free play). After carburetors are correctly synchronized, adjust idle speed and pump control cable.

Float level (H-Fig. Y4-2) should be $\frac{7}{8}$ inch (22MM) for YAS1 and CS3 models, $\frac{29}{32}$ inch (23MM) for YCS1 models), $\frac{13}{16}$ inch (21MM) for YCS1-C models and 1 inch (25.3 MM) on AS2C models. Float height is adjusted by bending tang (17) on float. Refer to Fig. Y4-1 and the following standard specifications:

YAS1, YAS1-C & AS2C

Main jet (9) ..... #95
Pilot jet (14) ..... #17.5
Needle jet (13) 0-0
Valve needle (6) 4D9
Clip (5) in fourth groove from top of needle (6).

YCS1

Main jet (9) ..... #65
Pilot jet (14) ..... #20
Needle jet (13) 0-0
Valve needle (6) 4D2
Clip (5) in third groove from top of needle (6).

YCS1-C, CS3B & CS3C

Main jet (9) ..... #65
Pilot jet (14) ..... #30
Needle jet (13) N-6
Valve needle (6) 4D10
Clip (5) in third groove from top of needle (6).

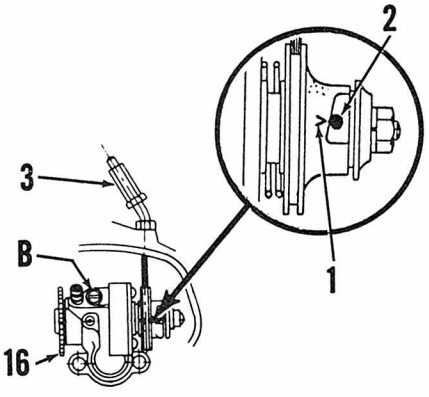
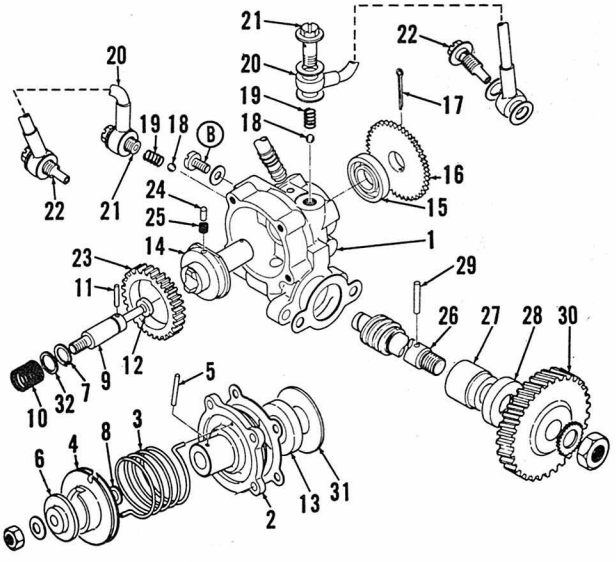


Fig. Y4-5—When carburetor controls are correctly adjusted and engine is at idle speed, mark (1) should be aligned with guide pin (2). Cable adjuster is shown at (3).

IGNITION AND ELECTRICAL. The alternator on YAS1 and AS2C models is located at left end of crankshaft. On YCS1 and CS3 models, the DC generator-starter unit is located at the left end of the crankshaft. On all models, the ignition breaker points and condensers are mounted on the stator plate and the ignition cam is attached to the end of the generator armature (rotor on YAS1 and AS2C models).

Fig. Y4-6—Exploded view of the oil injection pump unit.

1. Pump case
2. Cover
3. Pulley spring
4. Adjust pulley
5. Guide pin
6. Adjust plate
7. Snap ring
8. Shims
9. Plunger
10. Plunger return spring
11. Cam guide pin
12. Plunger oil seal
13. Plunger cam oil seal
14. Distributor
15. Oil seal
16. Starter plate
17. Drive pin
18. Check balls
19. Springs
20. Delivery pipes
21. Banjo bolts
22. Injector bolt
23. Worm wheel
24. Worm wheel pin
25. Spring
26. Worm shaft
27. Bushing
28. Oil seal
29. Pin
30. Drive gear
31. Worm wheel plate
32. Spring seat



Ignition breaker point gap at widest opening should be within limits shown in condensed data table. Ignition timing should be set as follows: Turn the crankshaft until the left piston is 0.070 (1.8MM) before top dead center. Pull the advance weights out to full advance position and block in this position. If the breaker points are not just open, loosen the mounting screws and move the front set of breaker points in the elongated holes until points just begin to open. Timing for the right cylinder is set in a similar way with dial indicator in right spark plug hole and moving the rear set of breaker points.

LUBRICATION. The engine is lubricated by oil contained in a separate tank. A pump and metering unit pumps oil from the tank to each cylinder inlet passage. The oil tank should **never** be allowed to run dry. SAE 30 two-stroke oil should be used. The oil pump control cable should be accurately adjusted to provide the correct amount of oil. If the cable adjustment is incorrect, the engine may be damaged.

Before adjusting the pump control cable, it is important that the throttle cable guides (1—Fig. Y4-1) are correctly set. To adjust the throttle cable guides, turn the idle speed screws (2A) out or idle speed adjuster (2C) all the way down, then synchronize cable guides (1) so that both throttle slides (7) begin to move at exactly the same time when the hand grip is turned. The throttle cables should have approximately $\frac{1}{16}$-inch free play after they are synchronized. Adjust the idle speed to 1,100-1,300 RPM by turning both idle screws (2A) or adjusters (2C). Make certain that both throttle slides stop at exactly the same time. Turn the throttle hand

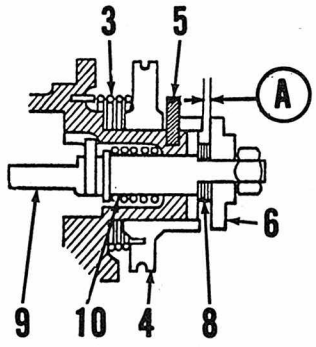


Fig. Y4-7—Clearance (A) is adjusted by varying shims (8).

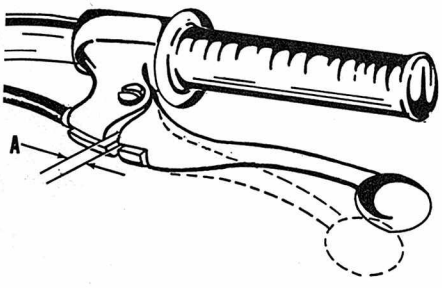


Fig. Y4-9—The clutch hand lever should have $\frac{1}{16}$-⅛-inch free play at (A).

grip just enough to take up free play from the throttle cables (without changing idle speed) and check the oil pump setting mark and guide pin as shown in Fig. Y4-5. If the mark (1) is not exactly aligned with guide pin (2); loosen the lock nut and turn the pump cable adjuster (3) as required to align.

Check the minimum plunger stroke by turning starter plate (16) until clearance (A—Fig. Y4-7) between pulley and adjusting plate is at its minimum. Clearance (A) should be 0.20-0.25MM (0.008-0.010 inch). If clearance is incorrect, add or deduct shims (8).

If oil lines are drained or pump is removed, it is important that all lines be filled before starting engine. Remove bleeder screw (B—Fig. Y4-5) and pull the pump control cable up out of cable guide (3). Turn starter plate (16) until oil without air bubbles flows from the bleeder screw hole, then reinstall bleeder screw (B) and start engine. Run engine at idle

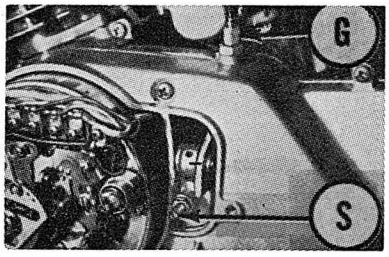


Fig. Y4-10—The clutch adjusting screw (S) is located under left side cover. Hand lever free play is adjusted at cable guide (G).

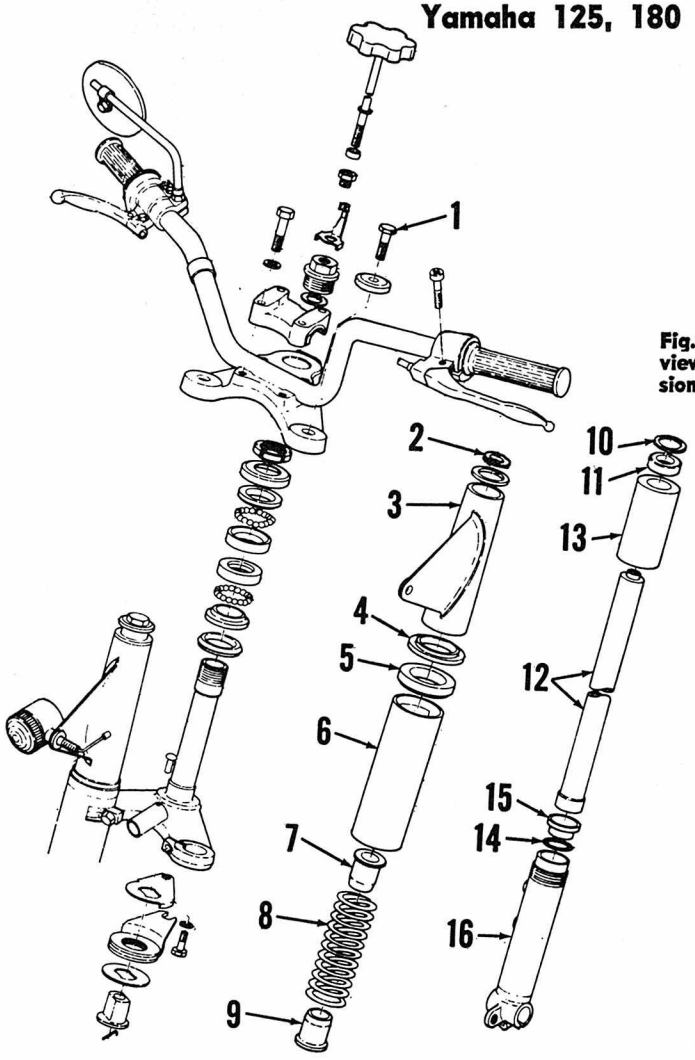


Fig. Y4-12 — Exploded view of the front suspension system used on most models.

1. Filler screw
2. Seal
3. Cover
4. Guide
5. Gasket
6. Cover
7. Spring seat
8. Spring
9. Spring seat
10. Washer
11. Oil seal
12. Inner tube
13. Tube nut
14. "O" ring
15. Bushing
16. Lower tube

speed until oil delivery lines (20—Fig. Y4-6) are free of air bubbles.

The gear box contains 1.6 pints of SAE 30 or 10W/30 motor oil and should be drained and refilled every 2000 miles.

CLUTCH CONTROLS. The clutch hand lever should have $\frac{1}{16}$-⅛ inch free play at (A—Fig. Y4-9). To adjust, remove the engine left side cover and loosen lock nut. Turn the adjusting screw (S—Fig. Y4-10) in until slight resistance is felt, then back screw out ¼ turn and tighten lock nut. Turn the cable guides at ends of cable until the hand lever free play (A—Fig. Y4-9) is correct.

SUSPENSION. Front suspension units on CS3C and CS3B models contain 175cc of fluid each. Units on all other models contain 160cc of oil each. The oil used should be a mixture of 80% SAE 30 motor oil and 20% SAE 60 spindle oil.

REPAIRS

PISTONS, RINGS AND CYLINDERS. Each piston can be removed after removing exhaust pipe, carburetor, cylinder head and cylinder. Re-

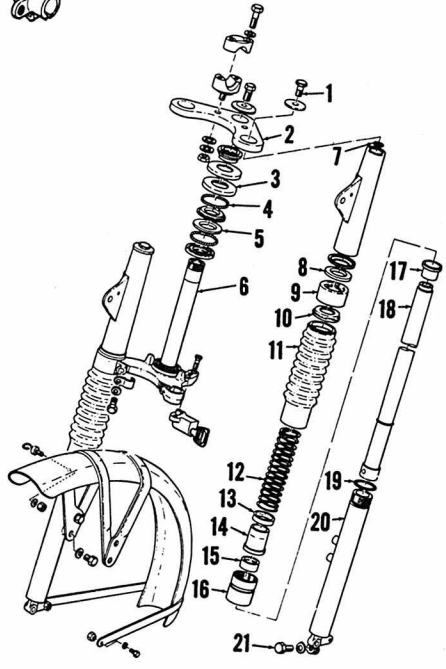


Fig. Y4-13—Exploded view of front suspension used on CS3 models.

1. Fork top bolt
2. Handle crown
3. Ball race
4. Ball bearings
5. Ball race
6. Steering stem assembly
7. "O" ring
8. Packing
9. Outer cover
10. Spring upper seat
11. Boot
12. Fork spring
13. Spacer
14. Lower spring seat
15. Oil seal
16. Outer nut
17. Metal slide
18. Inner tube
19. "O" ring
20. Outer tube
21. Axle pinch bolt

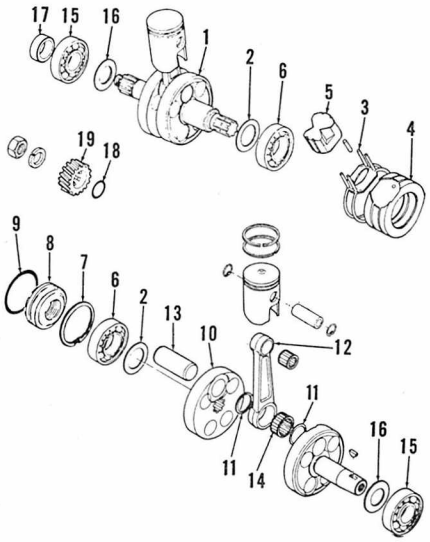


Fig. Y4-14—Exploded view of the crankshaft assembly.

1. Crankshaft right end
2. Shims
3. Gasket
4. Center housing
5. Filler
6. Center main bearings
7. Snap ring
8. Seal
9. "O" ring
10. Counter weight
11. Thrust washers
12. Connecting rod
13. Crankpin
14. Bearing
15. Main bearings
16. Shims
17. Oil seal collar
18. "O" ring
19. Crankshaft gear

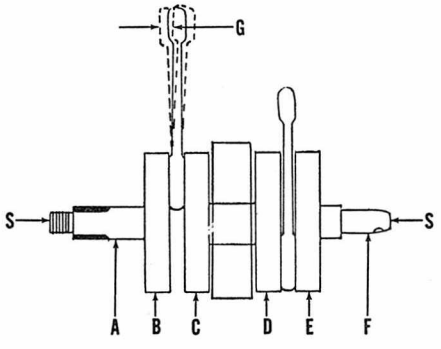


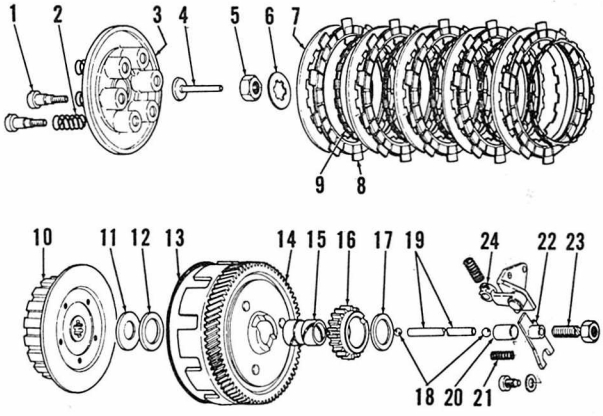
Fig. Y4-15—Refer to text for checking crankshaft assembly and wear limits.

fer to the following specifications:

Ring end gap .....0.006-0.013 inch
Ring groove
clearance .....0.0012-0.0028 inch
Standard cylinder bore cylinder—
125cc .....43MM (1.69 inches)
180cc .....50MM (1.97 inches)
200cc .....52MM (2.047 inches)
Maximum cylinder bore taper or
out of round .....0.002 inch
Piston skirt to cylinder clearance—
YAS1 .....0.0012-0.0014 inch
YCS1 .....0.0016-0.0018 inch
AS2C .....0.0019-0.0022 inch
CS3C & CS3B ..0.0012-0.0014 inch

Piston skirt clearance in cylinder bore should be measured by first measuring piston diameter at right angles to piston pin and cylinder bore diameter, then subtracting. The piston should be measured 10MM (0.4 inch) above bottom edge of skirt. On piston rings sets with a chrome ring and a black ring, install the chrome ring in top groove and black ring in second groove. Some ring sets will have two chrome rings. These can be installed in either groove. On late models, Keystone type pistons and rings are used. Keystone type pistons will be marked with a "K" stamped on top and Keystone rings will be marked "1N" or "1T" for a top ring and "2N" or "2T" for a bottom ring. Keystone rings cannot be used in a standard piston and standard rings cannot be used in a Keystone piston. Keystone pistons are supplied as replacement parts for all models. Marks on all piston rings go toward top. Make sure that rings correctly engage pins in the ring grooves. Pistons should be installed on connecting rods with arrow pointing toward front. Cylinder head stud nuts should be torqued to 180 inch-pounds.

CONNECTING RODS AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Connecting rods, crankpins, rod bearings and the center main bearings are removed by pressing the crankshaft apart. The crankshaft should be disassembled ONLY if required tools are available to correctly check and align the reassembled crankshaft. If side shake (G—Fig. Y4-15) at piston pin end of connecting rod exceeds 0.08 inch (2MM), the connecting rod, crankpin and lower bearing should be renewed. Shake (G) should be 0.032-0.039 inch (0.8-1.0MM). Side clearance of connecting rod between the crankshaft counter weights can be measured with a feeler gage. Side clearance should be 0.0039-0.012 inch (0.1-0.3MM). With crankshaft supported between lathe centers (S—Fig. Y4-15), maximum eccentricity when measured with dial indicator at points (A,B,C,D,E, & F) should not exceed 0.0008 inch.



1. Spring screws
2. Springs
3. Pressure plate
4. Release plunger
5. Nut
6. Lock plate
7. Driven plate (5 used)
8. Friction discs (5 used)
9. Separator rings (5 used)
10. Clutch hub
11. Thrust plate
12. Thrust bearing
13. Friction ring
14. Clutch drum
15. Bushing
16. Kick starter gear
17. Thrust plate
18. Balls
19. Release rod
20. Release cup
21. Release spring
22. Release lever
23. Adjusting screw
24. Release cam

Fig. Y4-16—Exploded view of the clutch assembly. Parts (20 thru 24) are located in left cover.

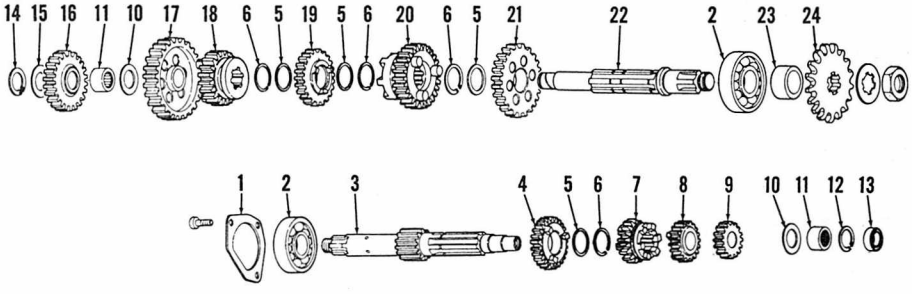


Fig. Y4-18—Exploded view of the transmission gears and shafts.

1. Bearing retainer
2. Bearing
3. Input shaft and first gear
4. Fifth gear
5. Thrust washers
6. Snap rings
7. Sliding gear (4th)
8. Third gear
9. Second gear
10. Shims
11. Bearings
12. Snap ring
13. Push rod oil seal
14. Snap ring
15. Thrust washer
16. Kick starter idler gear
17. First gear
18. Sliding gear (5th)
19. Fourth gear
20. Sliding gear (3rd)
21. Second gear
22. Output shaft
23. Spacer
24. Output sprocket

CLUTCH. The multiple disc, wet type clutch is located on the right end of the transmission input shaft. To remove the clutch it is necessary to first remove the engine right side cover.

Clutch friction discs (8—Fig. Y4-16) are 0.158 inch (4MM) thick and should be renewed if less than 0.146 inch thick. Free length of springs (2) is 1.34 inch when new. Springs should be renewed if free length is less than 1.299 inch. Inspect all parts for wear, warpage and evidence of overheating. Make sure that separator rings (9) are not twisted when installing.

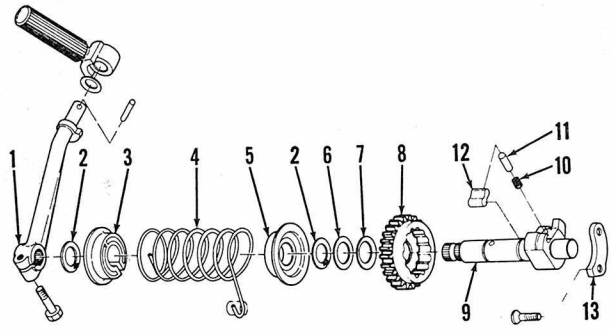
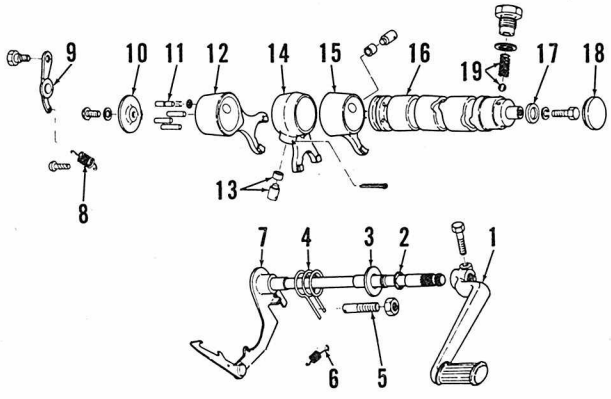


Fig. Y4-19 — Exploded view of kickstarter. Gear (8) meshes with gear (16—Fig. Y4-18).

1. Pedal
2. Snap rings
3. Spring cover
4. Return spring
5. Spring guide
6. Shim
7. Wave washer
8. Kick starter gear
9. Starter shaft
10. Spring
11. Plunger
12. Ratchet
13. Stop plate

Fig. Y4-20 — Exploded view of gear shift assembly.

1. Change pedal
2. Snap ring
3. Washer
4. Return spring
5. Stop screw
6. Ratchet spring
7. Change shaft and arm
8. Detent spring
9. Detent pawl
10. Side plate
11. Pins
12. Shift fork
13. Guide pin and roller
14. Shift fork
15. Shift fork
16. Shift drum
17. Retainer washer
18. Plug
19. Neutral detent ball and spring



CRANKCASE AND GEAR BOX. The crankshaft and transmission parts can be removed after the crankcase halves are separated.

To separate the crankcase halves, it is necessary to remove the engine from the frame. Remove cylinders, pistons, engine side covers, generator assembly, clutch assembly, crankshaft (primary drive) gear, kickstarter (including the idler gear) and the shift shaft and linkage. Remove the screws that attach the halves together and carefully separate the halves. The gears and shafts should stay in place in the crankcase left half. Refer to Figs. Y4-18, Y4-19, and Y4-20.

When reassembling, make sure that transmission parts are all in neutral position.

SPEED TUNING

A "GYT" kit is offered for the 125cc models. Many features of the "GYT" kit may be incorporated in standard parts. The following specifications may be used as a guide to modify these 125cc models to obtain better performance. Any modification of standard parts or installation of performance parts will void the manufacturers warranty.

Specifications from a 180cc road racing prepared YCS-1 are also listed.

CARBURETOR. A pair of 22 MM carburetors are recommended for use on 125cc models. The following jet sizes are recommended:

Main jet ..... #120
Pilot jet 30
Jet needle ..... 4 D 8
Needle jet N-6
Jet needle clip in second groove from top of needle.

To install the larger carburetors on standard cylinders, it is necessary to cut carburetor mount spigot off and fabricate a new mount spigot. Intake passages should be unobstructed when modifications are completed. Spigot should be installed at an angle that will allow carburetor to clear crankcase.

The YCS1 road racer is equipped with a Mikuni VM 27 SC with a remote float chamber. A carburetor adapter must also be constructed to mount larger (27 MM units) on the YCS-1.

IGNITION. Use of total loss ignition will yield approximately 3000 RPM increase in engine potential on the 125cc models.

A 100 Twin Jet "GYT" kit magneto may be fitted to 180cc twins with the construction of a special adapter plate.

Standard ignition timing should be used on all models.

LUBRICATION. Extended high speed operation (road racing) requires that oil metering pump be set at maximum stroke and a 30:1 fuel to oil mix be used in the fuel tank. Oil mixed in fuel should be same type used in oil tank (air cooled two stroke engine oil).

CYLINDERS, HEADS AND PISTONS. Remove 0.062 inch from cylinder heads and reshape taper at edge of combustion chamber. After modification of cylinder heads (for 125cc models) the capacity of one head should be 5.8cc.

Pistons (for 125cc models) should use only top (chrome) ring and should have 0.140 inch removed from skirt (I—Fig. YT4-1). All other dimensions remain standard.

Pistons for 180cc models may be modified to road racer specifications by removing 2 MM (0.078 inch) of metal from area adjacent to exhaust port (D—Fig. YT4-1). Cut should be 29 MM (1.141 inch) wide (E) and should taper back 12 MM (0.472 inch) toward center of piston. Cut should be gradual starting 2 MM deep at edge (G) of piston and ending toward center with no metal being removed. Cut 6 MM (0.236 inch) from piston skirt (I).

On 125cc models, fabricate a plate 0.062 inch thick using a cylinder base gasket as a template. Remove 0.062 inch from top of cylinder and install the plate with a base gasket on each side of it. This will effectively raise all ports. The following specifications and Fig. YT4-2 will illustrate some other possible modifications:

AS-1 Road Racer
(All dimensions in inches)

A. 2.164 (Mod.) 2.30 (Std.)
B. 1.27 (Mod.) 1.29 (Std.)
D. 1.27 (Mod.) 1.29 (Std.)
E. 0.885 (Mod.) 0.944 (Std.)
G. 2.99 (Mod.) 2.87 (Std.)

All other dimensions are left standard.

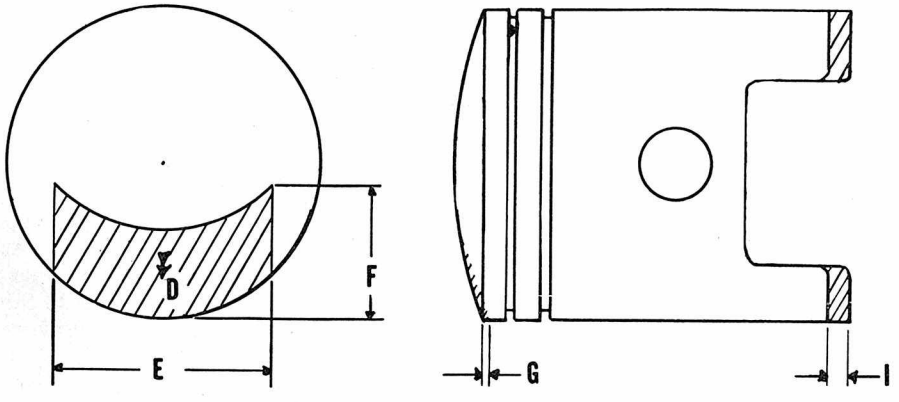


Fig. YT4-1—Areas of piston to be modified. Refer to text for appropriate dimensions.

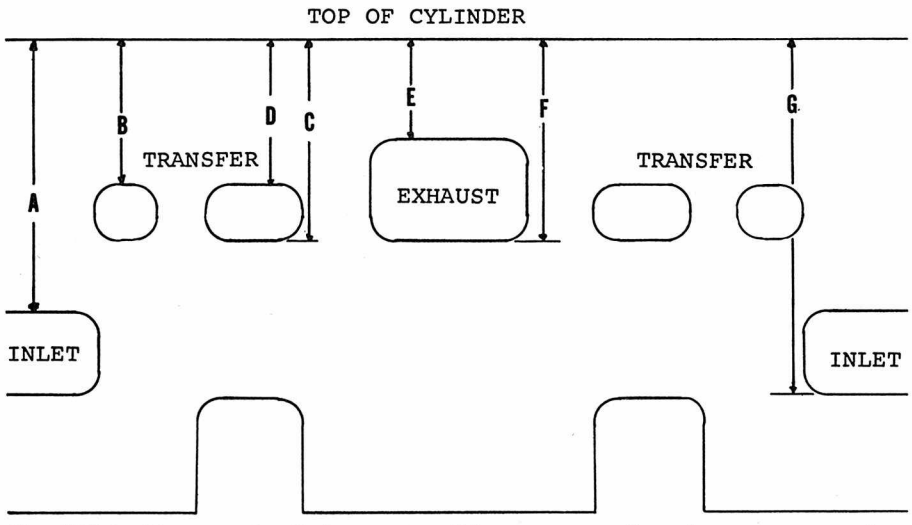


Fig. YT4-2—Diagram of cylinder porting. Take care to radius edges to prevent rings from hanging in ports after cylinder modifications.

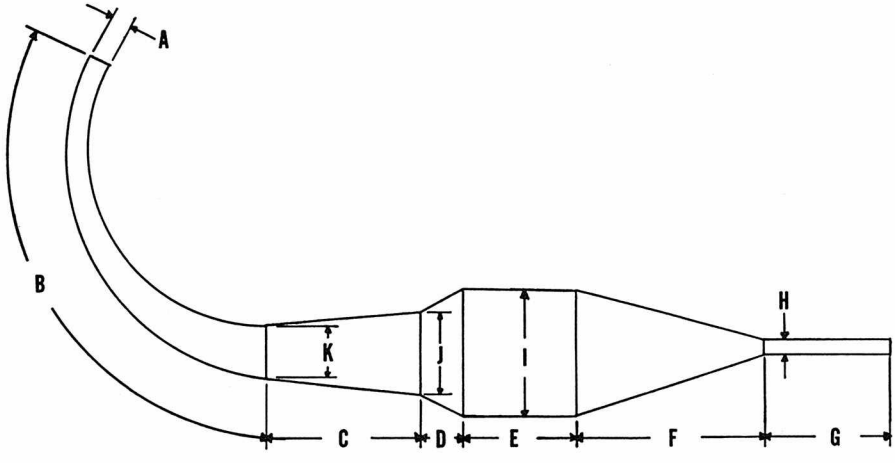


Fig. YT4-3—Basic expansion chamber diagram. Chambers vary greatly from one engine to the next due to type of riding to be done and variations in engine design. Refer to text for dimensions of particular models.

AS-1 and AS-2 "GYT" Kit

A. 2.165	D. 1.25	F. 1.73
C. 1.732	E. 0.874	G. 2.913

Dimension not listed are identical to standard.

The YCS-1 (180cc) road racer had 2MM (0.078 in.) removed from top of exhaust port (E—Fig. YT4-2). All other ports remained unchanged.

EXPANSION CHAMBER. The "GYT" kit expansion chambers are available. Similar expansion chambers may be constructed with the following specifications. Refer to Fig. YT4-3.

A. 35 MM (1.378 in.)
B. 362 MM (14.25 in.)
C. 130 MM (5.118 in.)
D. 20 MM (0.787 in.)
E. 42 MM (1.653 in.)
F. 175 MM (6.889 in.)
G. 208 MM (8.189 in.)
H. 20 MM (0.787 in.)
I. 90 MM (3.543 in.)
J. 90 MM (3.543 in.)
K. 55 MM (2.165 in.)

The 180cc YCS-1 road racer used TD1-B (250cc road racer) expansion chamber bodies modified to fit. A suitable high RPM chamber may be constructed with the following specifications: (Refer to Fig. YT4-3)

A. 40 MM (1.574 in.)
B. 307 MM (12.08 in.)
C. 150 MM (5.90 in.)
D. 55 MM (2.165 in.)
E. 120 MM (4.724 in.)
F. 145 MM (5.70 in.)
G. 200 MM (7.87 in.)
H. 20 MM (0.78 in.)
I. 95.5 MM (3.75 in.)
J. 81.25 MM (3.19 in.)
K. 74.5 MM (2.93 in.)

YAMAHA YDS-3 AND YM-1 MODELS

MODEL	YDS-3	YM-1
Displacement-cc	246	305
Bore-MM	56	60
Stroke-MM	50	54
Number of cylinders	2	2
Engine oiling system	"Autolube"	"Autolube"
Plug gap-inch	0.024-0.027	0.024-0.027
Point gap-inch	0.011-0.013	0.011-0.013
Ignition-type	Battery	Battery
Timing	Fixed	Fixed
Piston position BTDC-inch	0.071	0.079
Electrical system voltage	6	6
Battery terminal grounded	Negative	Negative
Tire size-front	3.00x18	3.00x18
Rear	*3.25x18	3.25x18
Tire pressure-front	22	22
Rear	28	28
Rear chain free play-inch	⅝-¾	⅝-¾
Number of speeds	5	5
Weight-lbs. (approx.)	325	331

*YDS-3C models use 3.50x18 rear tire.

MAINTENANCE

SPARK PLUGS. Recommended spark plug electrode gap is 0.024-0.027 inch (0.6-0.7MM). Suggested spark plug for normal use is NGK type B8HC. Champion L-5 or L-81 can be used.

CARBURETORS. Two Mikuni VM carburetors are used. Idle speed should be set at approximately 1,200 RPM by turning adjusters (2—Fig. Y5-1). Make sure that throttle slides (7) both stop at exactly the same position and exhaust pressure is the same for both cylinders. Idle mixture is changed by turning needles (11). Initial setting is 1½ turns open. Turning the needle counter-clockwise leans

the mixture. Carburetors must be synchronized to open exactly the same amount by turning cable guides (1) on top of each carburetor. To synchronize, begin by turning idle speed adjusters (2) all the way down, then adjust cable guides (1) to begin raising throttle slides at the same time. Throttle cables must have some slack (free play). After carburetors are correctly synchronized, adjust idle speed and pump control cable.

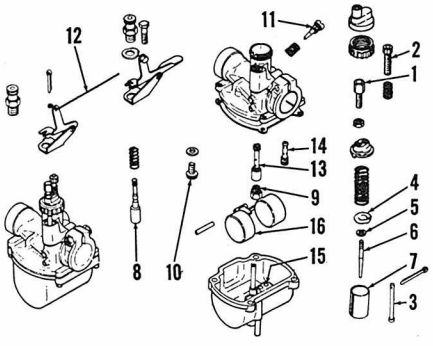


Fig. Y5-1—Exploded view of Mikuni VM carburetor. Starting valves for both carburetors are connected with rod (12).

1. Throttle cable guide
2. Idle speed adjuster
3. Idle speed rod
4. Retainer
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Fuel inlet valve
11. Idle mixture needle
12. Link rod
13. Needle jet
14. Pilot jet
15. Starting jet
16. Float

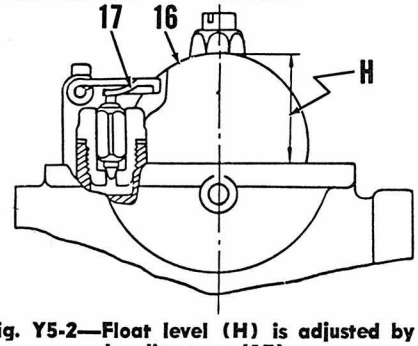


Fig. Y5-2—Float level (H) is adjusted by bending tang (17).

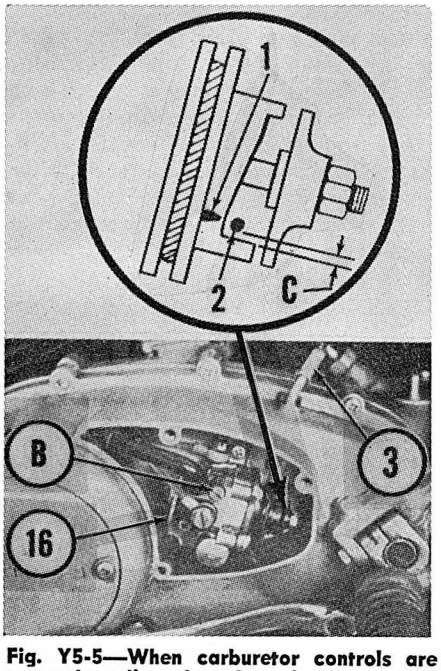


Fig. Y5-5—When carburetor controls are correctly adjusted and engine is at idle speed, mark (1) should be aligned with guide pin (2). Cable adjuster is shown at (3). Clearance (C) at idle should be 0.014-0.016 inch.

Float level (H—Fig. Y5-2) should be 1 inch (25.5MM) and is adjusted by bending tang (17) on float. Refer to Fig. Y5-1 and the following standard specifications:

YDS-3 and YDS-3C

Main jet (9) .....#120 or 130
Pilot jet (14) ..... #20
Needle jet (13) 0-0
Valve needle (6) 4D4
Clip (5) in second groove from top of needle (6).

YM-1

Main jet (9) ..... #130
Pilot jet (14) ..... #20
Needle jet (13) 0-0
Valve needle (6) 4D4
Clip (5) in second groove from top of needle (6).

IGNITION AND ELECTRICAL. All models are equipped with a battery ignition system with an individual set of breaker points, condenser and coil for each cylinder. The generator is mounted at the right end of the crankshaft and the breaker points are mounted on the generator stator.

Breaker point gap at maximum opening should be 0.011-0.013 inch (0.30-0.35MM). The breaker points should just open when the piston is 0.071 inch (1.8MM) BTDC on YDS-3 models and 0.079 inch (2.0MM) BTDC on YM-1 models. Ignition timing must be checked and adjusted individually for each cylinder. A static timing light or meter can be used to indicate point opening and a dial indicator in the spark plug hole to position the piston. Timing is changed by moving the breaker point assembly in the elongated holes after loosening the two mounting screws.

LUBRICATION. The engine is lubricated by oil contained in a separate tank. A pump and metering unit pumps oil from the tank to each cylinder inlet passage. The oil should **never** be allowed to run dry. SAE 30 two-stroke oil should be used. The oil pump control cable should be accurately adjusted to provide the correct amount of oil. If the cable adjustment is incorrect, the engine may be damaged.

Before adjusting the pump control cable, it is important that the throttle cable guides (1—Fig. Y5-1) are correctly set. To adjust the throttle cable guides, turn the idle speed adjusters (2) all the way down, then synchronize cable guides (1) so that both throttle slides (7) begin to move at exactly the same time when the hand grip is turned. The throttle cables should have approximately $\frac{1}{16}$-inch free play after they are synchronized. Adjust the idle speed to 1,100-1,300 RPM by turning both idle adjusters (2). Make certain that both throttle slides stop at exactly the same time. Turn the throttle hand grip just enough to take up free play from the throttle cables (without changing idle speed) and check the oil pump setting mark and guide pin as shown in Fig. Y5-5. If the "V" mark (1) is not exactly aligned with guide pin (2);

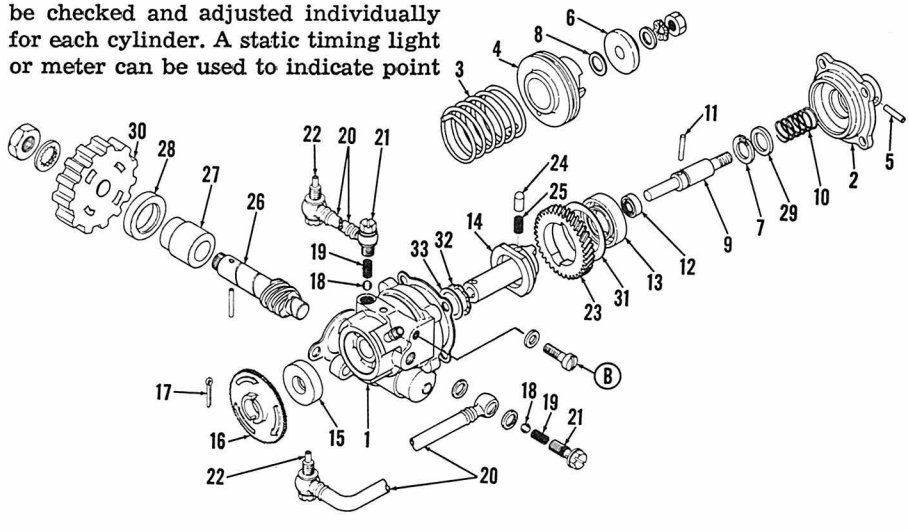


Fig. Y5-6—Exploded view of the oil injection pump unit. Bleeder screw is shown at (B).

1. Pump case
2. Cover
3. Pulley spring
4. Adjust pulley
5. Guide pin
6. Adjust plate
7. Snap ring
8. Shims
9. Plunger
10. Plunger return spring
11. Cam guide pin
12. Plunger oil seal
13. Plunger cam oil seal
14. Distributor
15. Oil seal
16. Starter plate
17. Drive pin
18. Check balls
19. Springs
20. Delivery pipes
21. Banjo bolts
22. Injector bolt
23. Worm wheel
24. Worm wheel pin
25. Spring
26. Worm shaft
27. Bushing
28. Oil seal
29. Spring seat
30. Drive gear
31. Worm wheel plate
32. Wave washer
33. Plate

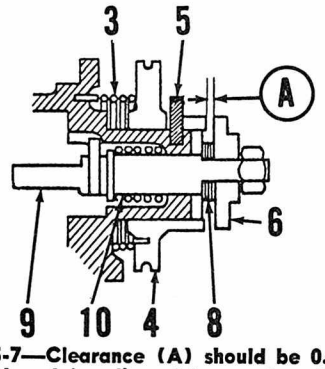


Fig. Y5-7—Clearance (A) should be 0.25-0.35MM and is adjusted by varying shims (8).

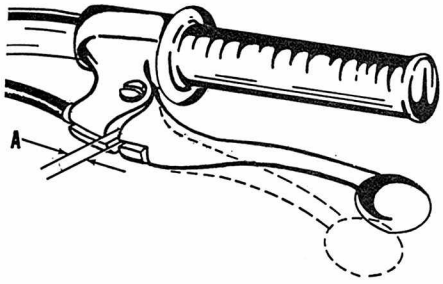


Fig. Y5-9—The clutch hand lever should have $\frac{1}{16}$-⅛-inch free play at (A).

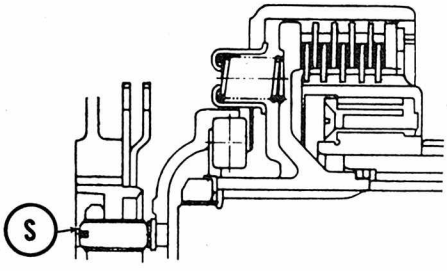


Fig. Y5-10—The clutch adjusting screw (S) is located under the small, round cover on engine left side cover.

loosen the lock nut and turn the pump cable adjuster (3) as required to align.

Check the minimum plunger stroke by turning starter plate (16—Fig. Y5-5) until clearance (A—Fig. Y5-7) between pulley and adjusting plate is at minimum. Clearance (A) should be 0.25-0.35MM (0.0098-0.0138 inch.) If clearance is incorrect, add or deduct shims (8).

If oil lines are drained or pump is removed, it is important that all lines be filled before starting engine. Remove bleeder screw (B—Fig. Y5-5) and pull the control cable up out of cable guide (3). Turn starter plate (16) until oil without air bubbles flows from the bleeder screw hole, then reinstall bleeder screw (B) and start engine. Run engine at idle speed until oil delivery lines (20—Fig. Y5-6) are free of air bubbles.

The gear box contains 1.7 quarts of SAE 30 or 10W/30 motor oil and should be drained and refilled every 2000 miles.

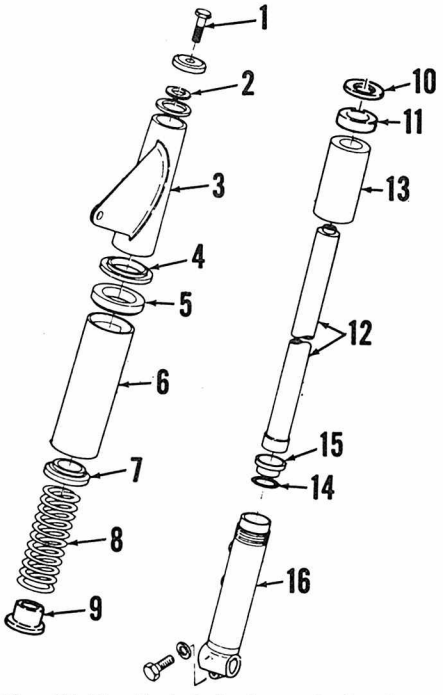


Fig. Y5-12—Exploded view of the front suspension system.

1. Filler screw
2. Seal
3. Cover
4. Guide
5. Washer
6. Cover
7. Spring seat
8. Spring
9. Spring seat
10. Washer
11. Oil seal
12. Inner tube
13. Tube nut
14. "O" ring
15. Bushing
16. Lower tube

CLUTCH CONTROLS. The clutch hand lever should have $\frac{1}{16}$-⅛ inch free play at (A—Fig. Y5-9). To adjust, remove the cover from left side of engine and loosen lock nut. Turn the adjusting screw (S—Fig. Y5-10) in until slight resistance is felt, then back screw out ¼ turn and tighten lock nut. Turn the cable guide at ends of cable until the hand lever free play (A—Fig. Y5-9) is correct.

SUSPENSION. Each front suspension unit contains 200cc of oil. The oil used should be a mixture of 80% SAE 30 motor oil and 20% SAE 60 spindle oil. Oil should be renewed every 4,000 miles.

REPAIRS

PISTONS, RINGS AND CYLINDERS. Each piston can be removed after removing exhaust pipe, carburetor, cylinder head and cylinder. Refer to the following specifications:

Ring end gap-
Top ring .....0.006-0.012 inch
Second ring .....0.004-0.008 inch
Standard cylinder bore diameter
YDS-3 .....56MM (2.20 inch)
YM-1 .....60MM (2.36 inch)
Maximum cylinder bore taper or out of round .....0.002 inch
Piston skirt to cylinder clearance-
YDS-3 .....0.0020-0.0022 inch
YM-1 .....0.0021-0.0023 inch

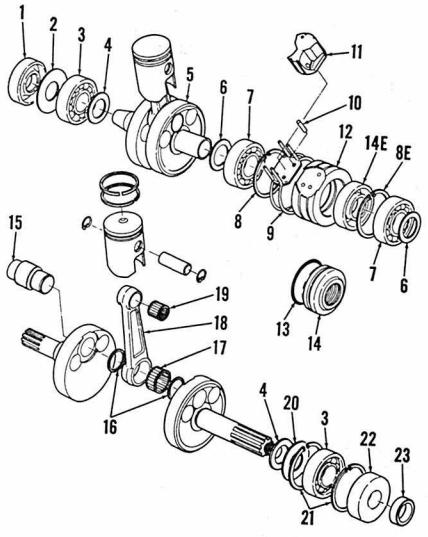


Fig. Y5-14—Exploded view of the crankshaft assembly. Parts (8E & 14E) should be discarded if later type seal (13 & 14) is installed

1. Oil seal
2. Bearing cover
3. Main bearings
4. Shims
5. Crankshaft right cylinder half
6. Shims
7. Center main bearings
8. Snap ring
8E. Snap ring (early models)
9. Gasket
10. Pin
11. Filler piece
12. Center housing
13. "O" ring (late type)
14. Center seal (late type)
14E. Center seal (early lip type)
15. Crankpin
16. Crankpin washers
17. Crankpin bearing
18. Connecting rod
19. Piston pin bearing
20. Shim
21. Snap ring
22. Oil seal
23. Collar

Piston skirt clearance in cylinder bore should be measured by first measuring piston diameter at right angles to piston pin and cylinder bore diameter, then subtracting. The piston should be measured 10MM (0.4 inch) above bottom edge of skirt. The dark piston ring should be installed in lower groove and chrome plated ring should be in top groove. Make sure that rings correctly engage pins in the ring grooves. Pistons should be installed on connecting rods with arrow pointing toward front. Cylinder head stud nuts should be torqued to 180 inch-pounds.

CONNECTING RODS AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Connecting rods, crankpins, rod bearings and the center main bearings are removed by pressing the crankshaft apart. The crankshaft should be disassembled **ONLY** if required tools are available to correctly check and align the reassembled crankshaft. If side shake (G—Fig. Y5-15) at piston pin end of connecting rod exceeds 0.08 inch (2MM), the connecting rod, crankpin and lower bearing should be renewed. Shake (G) should be 0.032-0.039 inch (0.8-1.0MM). Side clearance of connecting rod between the crankshaft counter weights can be measured with a feeler

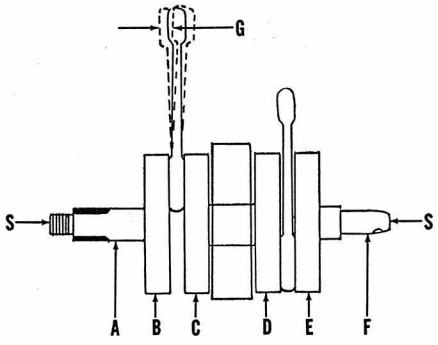


Fig. Y5-15—Refer to text to check crankshaft for correct assembly or wear.

gage. Side clearance should be 0.0039-0.012 inch (0.1-0.3MM). With crankshaft supported between lathe centers (S—Fig. Y5-15), maximum eccentricity when measured with dial indicator at points (A & F) should not exceed 0.0012 inch and should not exceed 0.0024 inch at points (B,C,D & E).

CLUTCH. The multiple disc wet type clutch is located on the left end of the crankshaft. The clutch can be removed after removing the engine left side cover and the clutch retaining nut (6—Fig. Y5-16).

Clutch friction discs (12) should be renewed if less than 0.158 inch (4MM) thick. Thickness when new is 0.169 inch (4.3MM). Free length of clutch springs (10) should be 1 inch (25.5-MM). Springs should be renewed if less than 0.925 inch (23.5MM). Inspect all parts for wear, warpage or evidence of overheating.

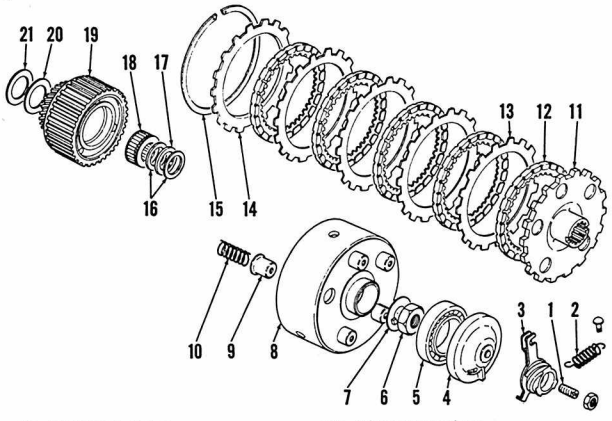


Fig. Y5-16 — Exploded view of the clutch assembly. Parts (1, 2 & 3) are located in the left cover.

1. Adjusting screw
2. Return spring
3. Release lever and screw
4. Push crown
5. Release bearing
6. Nut
7. Lock plate
8. Clutch drum
9. Spring cup
10. Spring
11. Drive plate
12. Friction discs (5 used)
13. Clutch plate (4 used)
14. Clutch plate (thick)
15. Snap ring
16. Thrust washers
17. Inner thrust washer
18. Primary drive gear bearing
19. Clutch hub and primary drive gear
20. Thrust washer (larger I.D.)
21. Thrust washer (small I.D.)

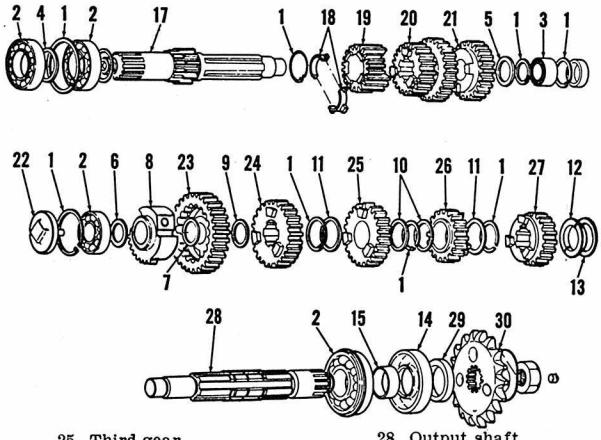


Fig. Y5-19 — Exploded view of transmission. Refer also to Fig. Y5-20.

1. Snap rings
2. Ball bearings
3. Needle bearing
4. Spacer
5. Washer
6. Shim
7. Thrust washer
8. Kick starter pinion
9. Spacer
10. Washers
11. Washers
12. Setting plate
13. Shim
14. Oil seal
15. Collar
17. Input shaft
18. Setting plate
19. Second gear
20. Third & fifth gear
21. Fourth gear
22. Oil catcher
23. First gear
24. Second gear
25. Third gear
26. Fifth gear
27. Fourth gear
28. Output shaft
29. Spacer
30. Output sprocket

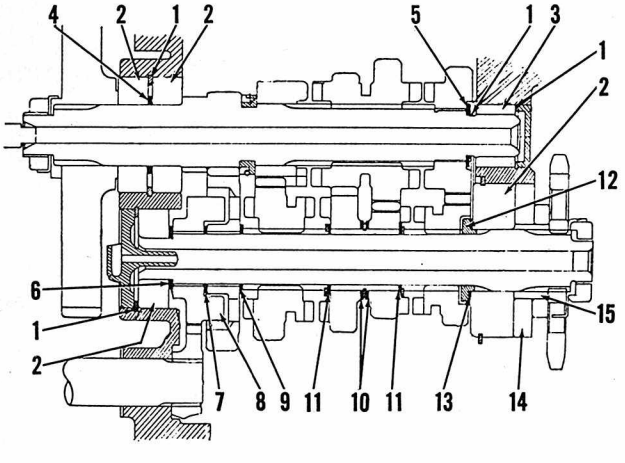


Fig. Y5-20 — Cross sectional view of the transmission assembly showing location of spacers and washers.

1. Snap rings
2. Ball bearings
3. Needle bearing
4. Spacer (1.8 MM)
5. Washer (1.0 MM)
6. Shim
7. Thrust washer O. D. 26 MM (1.0 MM thick)
8. Kickstarter pinion
9. Spacer O. D. 28 MM (1.0 MM thick)
10. Washers O. D. 32 MM (1.0 MM thick)
11. Washers O.D. 26 MM (1.0 MM thick)
12. Setting plate
13. Shim O. D. 34 MM (1.2 MM thick)
14. Oil seal
15. Collar

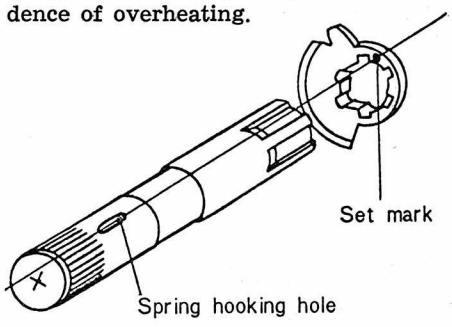


Fig. Y5-21 — Mark on kickstarter gear should be aligned with spring hooking hole as shown.

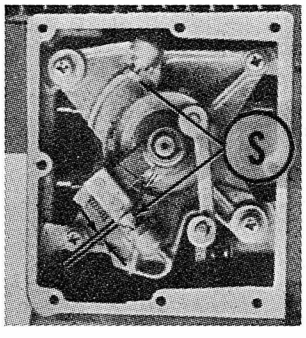


Fig. Y5-22—Gear change stop bolts (S) should have approximately 1 MM clearance when stop ball engages detent in shifter cam.

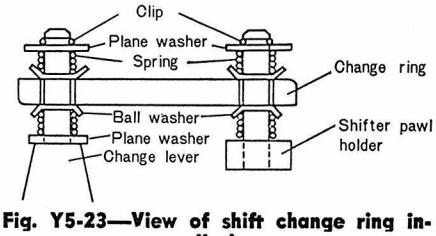


Fig. Y5-23—View of shift change ring installation.

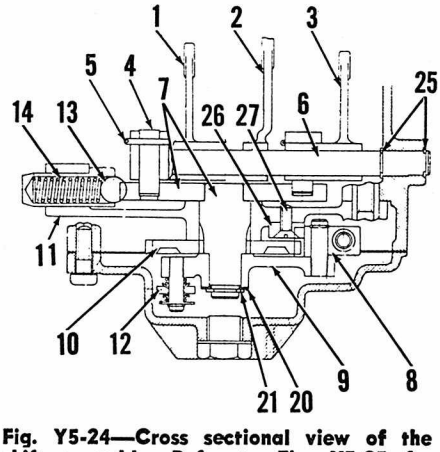


Fig. Y5-24—Cross sectional view of the shift assembly. Refer to Fig. Y5-25 for legend.

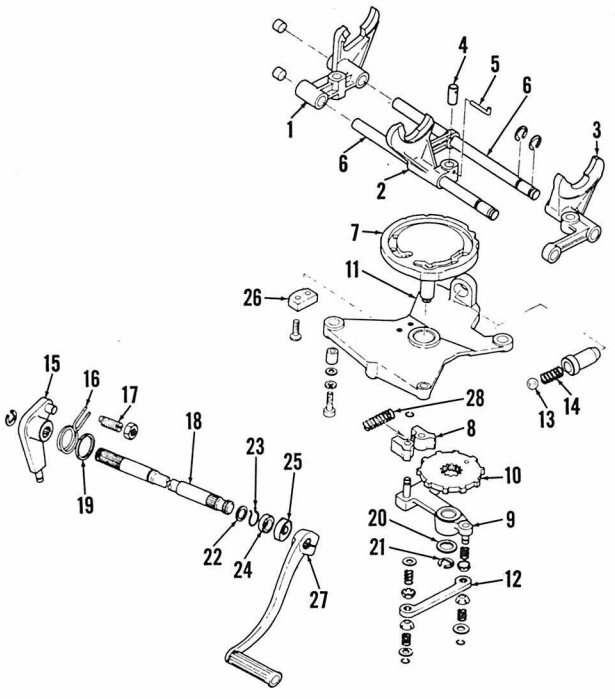
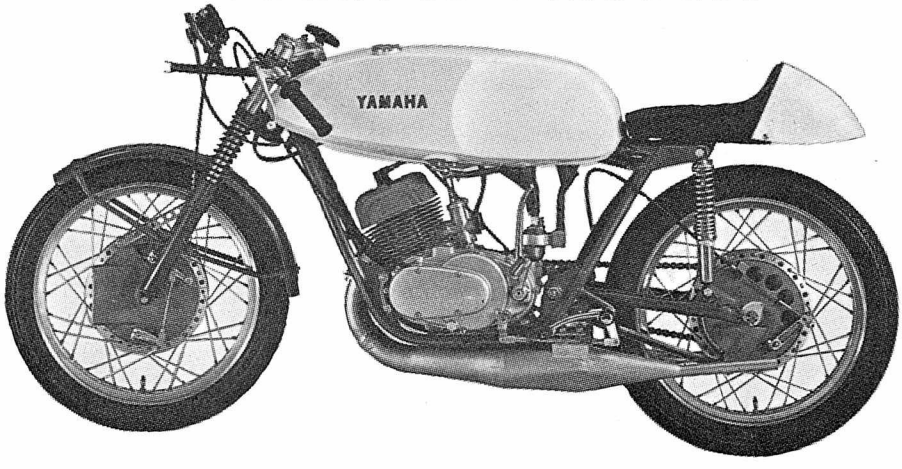


Fig. Y5-25 — Exploded view of shift assembly. Shift fork (1) moves gear (26—Fig. Y5-19), fork (2) moves gear (20—Fig. Y5-19) and fork (3) moves gear (24—Fig. Y5-19).

1. Shift fork (5th)
2. Shift fork (2nd & 4th)
3. Shift fork (1st & 3rd)
4. Shift rotor (3 used)
5. Stop pin (3 used)
6. Shift rails
7. Shift cam
8. Shifter pawls
9. Pawl holder
10. Working plate
11. Mounting plate
12. Change link
13. Cam detent ball
14. Detent spring
15. Change lever
16. Return spring
17. Eccentric screw
18. Shift pedal shaft
19. Washer
20. Shims
21. Snap ring
22. Washer
23. Snap ring
24. Oil seal
25. Seal
26. Pawl plate
27. Shift pedal

CRANKCASE AND GEAR BOX. The 5 speed transmission is shown in Figs. Y5-19 and Y5-20. The kick-starter gear should be installed on shaft with mark on gear aligned with spring hooking hole as shown in Fig. Y5-21. Shifter stop bolts (S—Fig. Y5-22) should have approximately 1MM (0.04 in.) clearance as the stop ball falls into detent in the cam.

YAMAHA TD-1 MODELS



TD1A and TD1B models are similar to the YDS-3 models. Refer to the preceeding YDS-3 section for service except for the following differences. The TD1C model is similar to the YDS-5. Refer to the appropriate (YDS-5) section for service except for the following differences.

MODEL	TD1A	TD1B	TD1C
Displacement-cc	246	246	246
Bore-MM	56	56	56
Stroke-MM	50	50	50
Number of cylinders	2	2	2
Oil-fuel ratio	*	*	*
Plug gap-inch	0.024-0.027	0.024-0.027	0.024-0.027
Point gap-inch	0.010-0.012	0.010-0.012	0.010-0.012
Ignition-type	Magneto	Magneto	Magneto
Timing	Fixed	Fixed	Fixed
Piston position BTDC-inch	0.083	0.079	0.079
Tire size-front	2.50x18	2.75x18	2.75x18
Rear	2.75x18	3.00x18	3.00x18
Number of speeds	5	5	5
Weight-lbs. (approx.)	244	244	228

*Oil to fuel ratio should be from 1:12 to 1:16 depending upon conditions.

MAINTENANCE

SPARK PLUG. Normally NGK type B10EN or B11EN spark plugs can be used; however, specific heat range should be chosen carefully. Electrode gap should be 0.024-0.027 inch (0.6-0.7MM). NGK type B8HN or B8HC spark plugs can be used to warm up engine.

CARBURETORS. Two Mikuni VM 276 carburetors are used with a remote float chamber for each. Make certain that carburetors are perfectly synchronized to open exactly alike when the throttle grip is opened.

Refer to Fig. Y6-1 and the following for normal carburetor specification data. Because of varying conditions, it may be necessary to deviate from these settings.

Main jet (9)—
TD1A .....#200
TD1B .....#190
TD1C .....#220
Needle jet (8) Q-3
Valve needle (7) 6A1
Pilot jet ..... #25
Initial setting of needle (11) is 1¼-1¾ turns open.

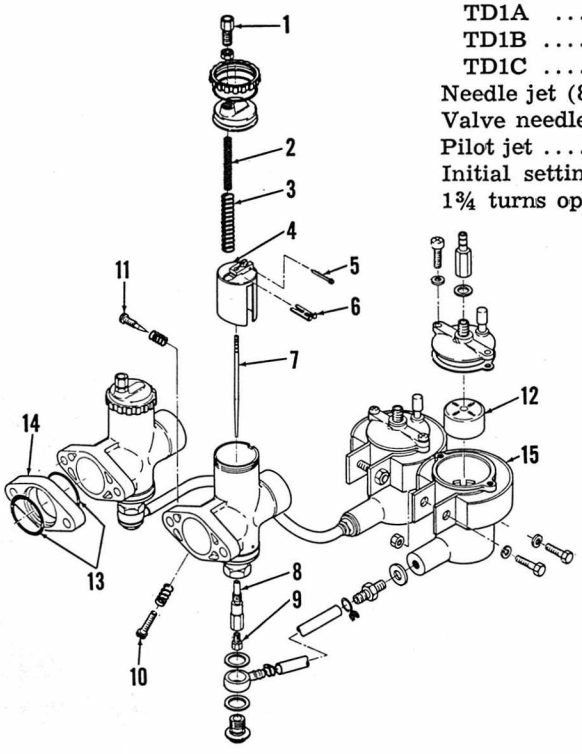


Fig. Y6-1—Exploded view of Mikuni VM 276 carburetors and float bowls.

1. Throttle cable guide
2. Throttle spring
3. Throttle spring
4. Throttle slide
5. Cotter pin
6. Clip
7. Valve needle
8. Needle jet
9. Main jet
10. Idle speed screw
11. Idle mixture needle
12. Float
13. "O" ring
14. Insulator
15. Float chamber holder

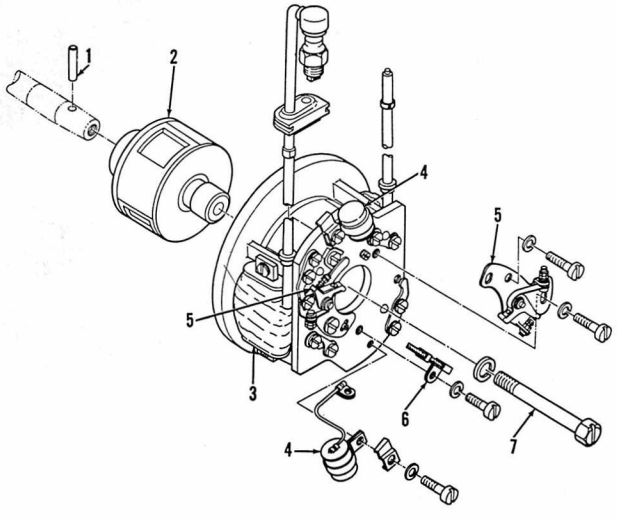


Fig. Y6-2—Exploded view of the magneto assembly.

1. Rotor drive pin
2. Rotor
3. Coil (2 used)
4. Condensers
5. Breaker points
6. Cam oiler
7. Rotor retaining screw

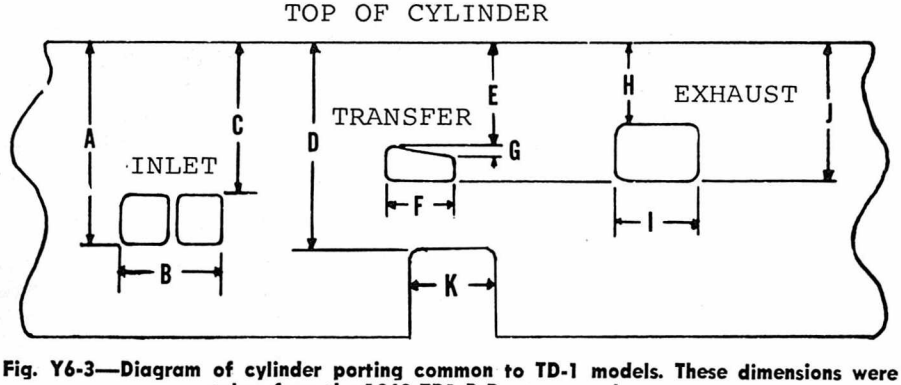


Fig. Y6-3—Diagram of cylinder porting common to TD-1 models. These dimensions were taken from the 1968 TD1-B Daytona road racer.

A. 3.375 in. (86 MM)	D. 3.687 in. (94 MM)	G. 0.059 in. (1.5 MM)	J. 1.968 in. (50 MM)
B. 1.417 in. (36 MM)	E. 1.456 in. (37 MM)	H. 1.060 in. (27 MM)	K. 1.259 in. (32 MM)
C. 2.438 in. (62 MM)	F. 0.900 in. (23 MM)	I. 1.456 in. (37 MM)	

Clip (6) should be in third groove from top of needle (7).

IGNITION. The ignition system magneto is mounted at the right end of the crankshaft. Refer to Fig. Y6-2 for exploded view. Breaker point gap at maximum opening should be 0.010-0.012 inch (0.25-0.30MM). Breaker points should just open when piston is 0.083 inch (2.1MM) BTDC on TD1A models; 0.079 inch (2.0MM) BTDC on TD1B and TD1C models. Timing is set individually for each cylinder and should be exactly alike.

LUBRICATION. The engine is lubricated by oil mixed with the fuel. Recommended oil to fuel ratio is within the range of 1:12 and 1:16.

The clutch and transmission are lubricated by 1½ quarts of SAE 30 oil. Oil should be drained, case flushed with new oil and refilled with new oil before each race. Make certain that drain plug is safetied with wire.

SUSPENSION. Type and quantity of oil in the front suspension will depend upon conditions. Normal capacity is 195cc (6.6 fl. oz.) in each unit.

SPECIAL NOTES. It is important that all screws and nuts be safetied using safety wire, lock plates, lock washers or locking compound (such as Locktite). All parts should be checked often for security.

Be extremely careful when servicing with fuel (and oil mixture). Filters should be used when filling to prevent foreign matter from entering tank.

REPAIRS

PISTONS, RINGS AND CYLINDERS. Only one ring is used on each piston. The clearance between the piston and cylinder should be checked by measuring piston diameter at skirt at right angles to piston pin and cylinder diameter, then subtracting. Clearance should be 0.0024-0.0026 inch (0.060-0.065MM) for TD1A; 0.0018-0.0020 inch (0.045-0.050MM) for TD1B and TD1C. The pistons used in the TD1-B are 9MM (0.35 in.) shorter than YDS-3 pistons.

When breaking in, the pistons should be removed after short running and checked for any polished surfaces. If piston contacts cylinder wall, surface of piston will be polished and should be smoothed with #400 or #600 sandpaper. Clean thoroughly and reassemble. Be sure to use new piston pin retaining snap rings and make sure that rings fully engage grooves in piston bores.

CLUTCH. The clutch on TD1A and TD1B models is mounted on the left end of the crankshaft and is similar to YDS-3 models. Refer to the pre-

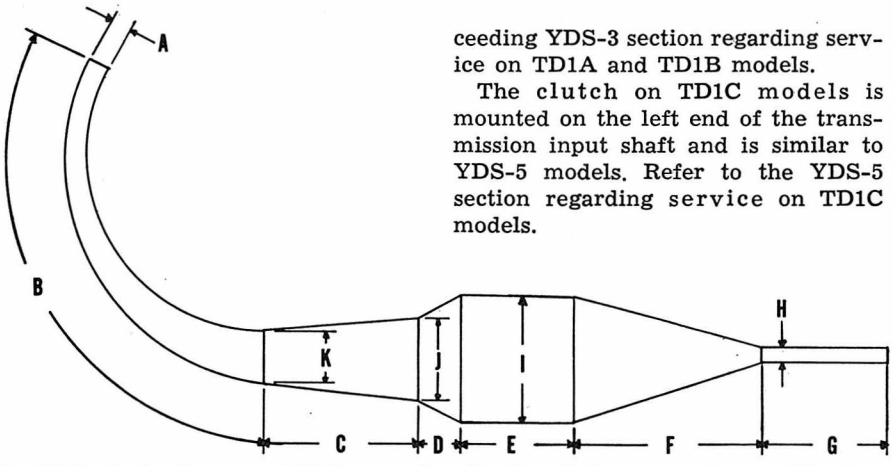


Fig. Y6-4—Basic diagram of TD-1 expansion chamber. Refer to text for specifications.

ceeding YDS-3 section regarding service on TD1A and TD1B models.

The clutch on TD1C models is mounted on the left end of the transmission input shaft and is similar to YDS-5 models. Refer to the YDS-5 section regarding service on TD1C models.

EXPANSION CHAMBER. An expansion chamber with the characteristics of the 1968 Daytona road racer may be constructed with the following specifications. (Refer to Fig. Y6-4).

A. 40 MM (1.574 in.)
B. 307 MM (12.08 in.)
C. 193 MM (7.598 in.)
D. 55 MM (2.165 in.)
E. 159 MM (6.259 in.)
F. 178 MM (7.00 in.)
G. 173 MM (6.811 in.)
H. 20 MM (0.787 in.)
I. 95.5 MM (3.75 in.)
J. 81.25 MM (3.20 in.)
K. 75.4 MM (2.97 in.)

YAMAHA YDS-5, DS6 AND YM2-C MODELS

MODEL	YDS-5	YM-2C	DS6
Displacement-cc	246	305	246
Bore-MM	56	60	56
Stroke-MM	50	54	50
Number of cylinders	2	2	2
Oil to fuel ratio		Oil Injection	
Plug gap-inch	0.020-0.023	0.020-0.023	0.020-0.023
Point gap-inch	0.012-0.014	0.012-0.014	0.012-0.016
Ignition-type	Battery	Battery	Battery
Timing	Automatic advance	Fixed	Fixed
Piston position BTDC-inch	*0.071	0.083	0.071
Electrical system voltage	12	12	12
Battery terminal grounded	Negative	Negative	Negative
Tire size-front	3.00x18	3.00x18	3.00x18
Rear	3.25x18	3.25x18	3.25x18**
Tire pressure-front	22	22	23
Rear	28	28	29
Rear chain free play-inch	⅝-¾	⅝-¾	¾
Number of speeds	5	5	5
Weight-lbs. (approx.)	324	326	304†

*Full advance timing for YDS-5.
**Rear tire on DS6C is 3.50x18.
†DS6C weight is 309 lbs. (approx.)

MAINTENANCE

SPARK PLUGS. Recommended spark plug electrode gap is 0.020-0.023 inch. DS6 models should be equipped with NGK type B9HC spark plugs for normal use. All other models use NGK type B8HC. Champion L57R can be used in DS6 models and Champion L60R for other models.

CARBURETORS. Two Mikuni VM carburetors are used. Idle speed should be set at approximately 1,200 RPM by turning adjusters (2—Fig. Y7-1). Make sure that throttle slides (7) both stop at exactly the same position and exhaust pressure is the same for both cylinders. Idle mixture is changed by turning needles (11). Initial setting is 1½ turns open. Turning the needle counter-clockwise leans the mixture. Carburetors must be synchronized to open exactly the same amount by turning cable guides (1) on top of each carburetor. To synchronize, begin by turning idle speed adjusters (2) all the way down, then adjust cable guides (1) to begin raising throttle slides at the same time. Throttle cables must have some slack (free play). After carburetors are correctly synchronized, adjust idle speed and pump control cable.

Float level (H—Fig. Y7-2) should be 1 inch (25.5MM) and is adjusted by bending tang (17) on float. Refer to Fig. Y7-1 and the following standard specifications:

YDS-5 and YM-2C

Main jet (9)-
YDS-5 ..... #120
YM-2C ..... #110
Pilot jet (14) ..... #30
Needle jet (13) 0-5
Valve needle (6) 4D3
Clip (5) in second groove from top of needle (6).

DS6

Main jet (9) ..... #110
Pilot jet (14) ..... #30

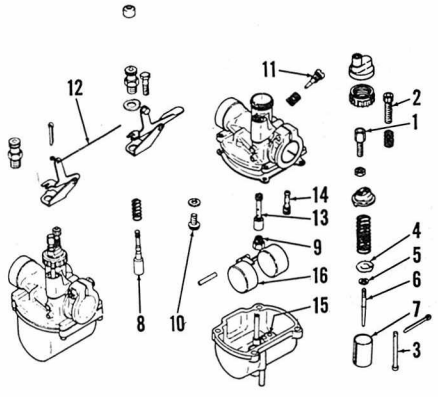


Fig. Y7-1—Exploded view of Mikuni VM carburetor. Starting valves for both carburetors are connected with rod (12).

1. Throttle cable guide
2. Idle speed adjuster
3. Idle speed rod
4. Retainer
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Fuel inlet valve
11. Idle mixture needle
12. Link rod
13. Needle jet
14. Pilot jet
15. Starting jet
16. Float

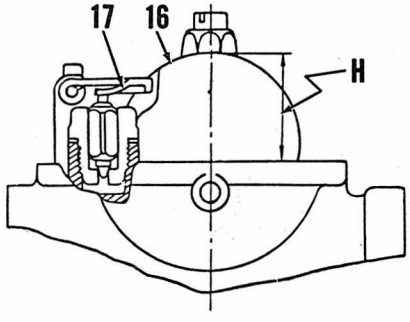


Fig. Y7-2—Float level (H) is adjusted by bending tang (17).

Needle jet (13) N-8
Valve needle (6) 4D3
Clip (5) in the third groove from the top of needle (6).

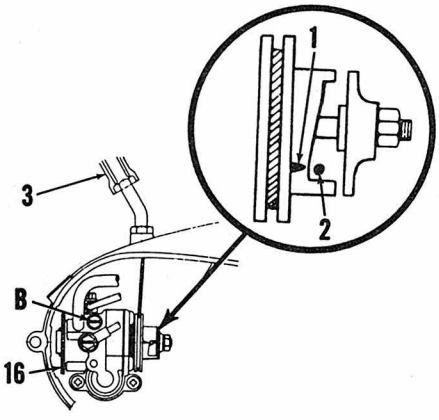


Fig. Y7-5—When carburetor controls are correctly adjusted and engine is at idle speed, mark (1) should be aligned with guide pin (2). Cable adjuster is shown at (3).

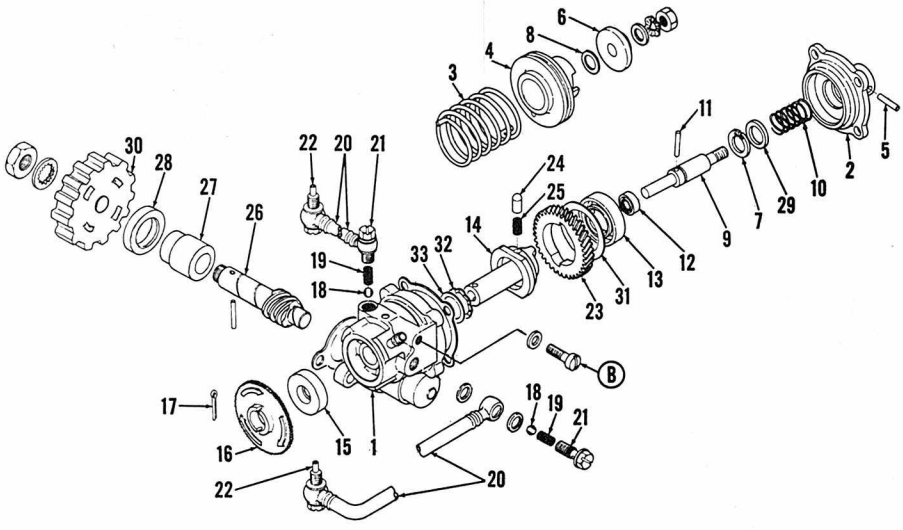


Fig. Y7-6—Exploded view of the oil injection pump unit.

1. Pump case
2. Cover
3. Pulley spring
4. Adjust pulley
5. Guide pin
6. Adjust plate
7. Snap ring
8. Shims
9. Plunger
10. Plunger return spring
11. Cam guide pin
12. Plunger oil seal
13. Plunger cam oil seal
14. Distributor
15. Oil seal
16. Starter plate
17. Drive pin
18. Check balls
19. Springs
20. Delivery pipes
21. Banjo bolts
22. Injector bolt
23. Worm wheel
24. Worm wheel pin
25. Spring
26. Worm shaft
27. Bushing
28. Oil seal
29. Spring seat
30. Drive gear
31. Worm wheel plate
32. Wave washer
33. Plate

IGNITION AND ELECTRICAL. All models are equipped with a battery ignition system with an individual set of breaker points, condenser and coil for each cylinder. The generator is mounted at the right end of the crankshaft and the breaker points are mounted on the generator stator. On YDS-5 models, the generator is a combined starter and generator unit. The starter (solenoid) relay is incorporated into voltage regulator located under the seat.

Breaker point gap at maximum opening should be within limits in condensed data table. The breaker points should just open when the piston is 0.071 inch (1.8MM) BTDC on YDS-5 and DS6 models and 0.083 inch (2.1MM) BTDC on YM-2C models. On YDS-5 models, make sure that ignition advance weights are fully extended (out) when checking the timing. On all models, ignition timing must be checked and adjusted individually for each cylinder. A static timing light or meter can be used to indicate point opening and a dial indicator in the spark plug hole to position the piston. Timing is changed by moving the breaker point assembly in the elongated holes after loosening the two mounting screws.

LUBRICATION. The engine is lubricated by oil contained in a separate tank. A pump and metering unit pumps oil from the tank to each cylinder inlet passage. The oil tank should never be allowed to run dry. SAE 30 two-stroke oil should be used. The oil pump control cable should be accurately adjusted to provide the correct amount of oil. If the cable adjustment is incorrect, the engine may be damaged.

Before adjusting the pump control cable, it is important that the throttle cable guides (1—Fig. Y7-1) are correctly set. To adjust the throttle cable guides, turn the idle speed adjusters (2) all the way down, then synchronize cable guides (1) so that both throttle slides (7) begin to move at exactly the same time when the hand grip is turned. The throttle cables should have approximately $\frac{1}{16}$-inch free play after they are synchronized. Adjust the idle speed to 1,100-1,300 RPM by turning both idle adjusters (2). Make certain that both throttle slides stop at exactly the same time. Turn the throttle hand grip just enough to take up free play from the throttle cables (without changing idle speed) and check the oil pump setting mark and guide pin as shown in Fig. Y7-5. If the "V" mark (1) is not exactly aligned with guide pin (2); loosen the lock nut and turn the pump cable adjuster (3) as required to align.

Check the minimum plunger stroke by turning starter plate (16) until clearance (A—Fig. Y7-7) between pulley and adjusting plate is at minimum. Clearance (A) should be 0.20-0.25 MM (0.008-0.0098 inch) on DS6 models and 0.25-0.35 MM (0.0098-0.013 inch) on all others. If clearance is incorrect, add or deduct shims (8).

If oil lines are drained or pump is removed, it is important that all lines be filled, before starting engine. Remove bleeder screw (B—Fig. Y7-5) and pull the control cable up out of cable guide (3). Turn starter plate (16) until oil without air bubbles flows from the bleeder screw hole, then reinstall bleeder screw (B) and start engine. Run engine at idle speed until oil delivery lines (20—Fig. Y7-6) are free of air bubbles.

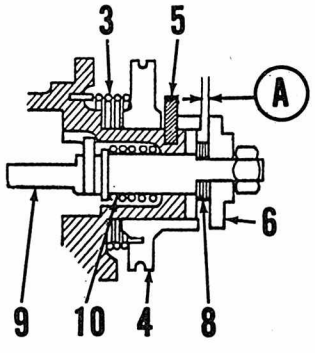


Fig. Y7-7—Clearance (A) is adjusted by varying shims (8).

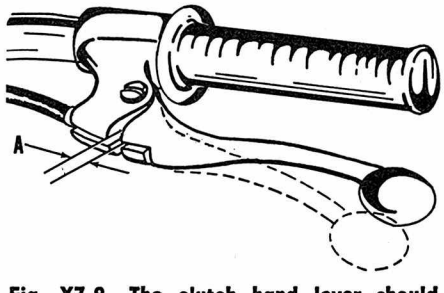


Fig. Y7-9—The clutch hand lever should have $\frac{1}{16}$-$\frac{1}{8}$-inch free play at (A).

The gear box contains 1¾ quarts of SAE 30 or 10W/30 motor oil and should be drained and refilled every 1200 miles.

CLUTCH CONTROLS. The clutch hand lever should have $\frac{1}{16}$-$\frac{1}{8}$ inch free play at (A—Fig. Y7-9). To adjust, remove the cover from left side of engine and loosen lock nut. Turn the adjusting screw (S—Fig. Y7-10) in until slight resistance is felt, then

back screw out ¼ turn and tighten lock nut. Turn the cable guide at hand lever end of cable until the hand lever free play (A—Fig. Y7-9) is correct.

SUSPENSION. Each front suspension unit contains 200cc of oil. The oil used should be a mixture of 80% SAE 30 motor oil and 20% SAE 60 spindle oil. Oil should be renewed every 2,000 miles.

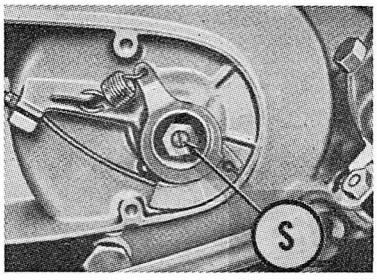


Fig. Y7-10—The clutch adjusting screw (S) is located under the cover on left side of engine.

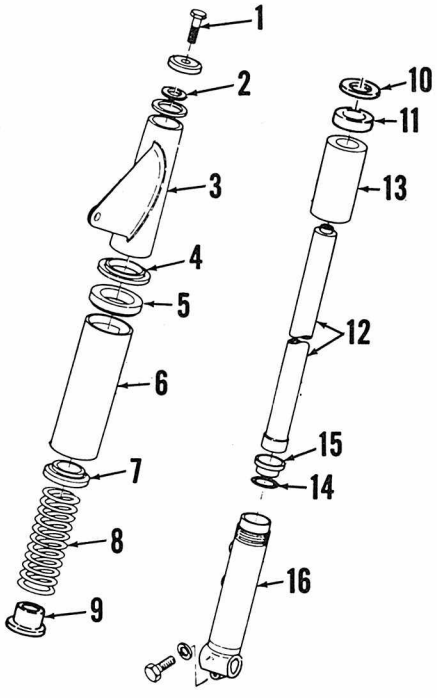


Fig. Y7-12—Exploded view of the front suspension system.

1. Filler screw
2. Seal
3. Cover
4. Guide
5. Gasket
6. Cover
7. Spring seat
8. Spring
9. Spring seat
10. Washer
11. Oil seal
12. Inner tube
13. Tube nut
14. "O" ring
15. Bushing
16. Lower tube

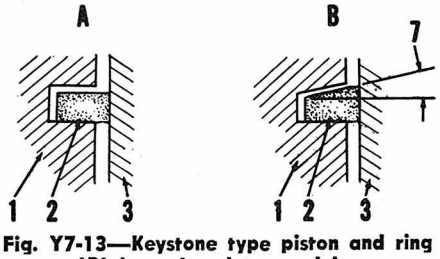


Fig. Y7-13—Keystone type piston and ring (B) is used on later models.

1. Piston
2. Ring
3. Cylinder wall

REPAIRS

PISTONS, RINGS AND CYLINDERS. Each piston can be removed after removing exhaust pipe, carburetor, cylinder head and cylinder. Refer to the following specifications:

Ring end gap-
YDS-5 & YM2C
Top ring .....0.006-0.012 inch
Second ring .....0.004-0.008 inch
DS6—both rings ..0.006-0.014 inch
Standard cylinder bore diameter
YDS-5 .....56MM (2.20 inch)
YM-2C .....60MM (2.36 inch)
DS6 .....56MM (2.20 inch)
Maximum cylinder bore taper or out of round .....0.002 inch
Piston skirt to cylinder clearance .....0.0014-0.0016 inch

Piston skirt clearance in cylinder bore should be measured by first measuring piston diameter at right angles to piston pin and cylinder bore diameter, then subtracting. The piston should be measured 10MM (0.4 inch) above bottom edge of skirt. Make sure

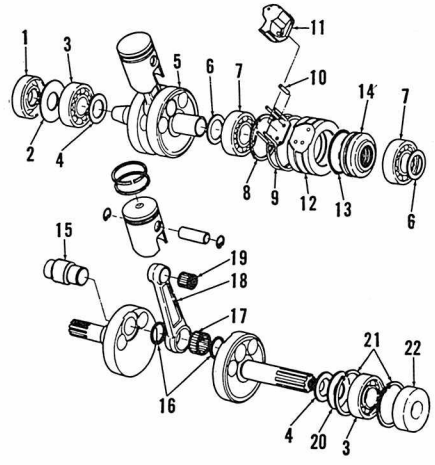


Fig. Y7-14—Exploded view of the crankshaft assembly.

1. Oil seal
2. Bearing cover
3. Main bearings
4. Shims
5. Crankshaft right cylinder half
6. Shims
7. Center main bearings
8. Snap ring
9. Gasket
10. Pin
11. Filler piece
12. Center housing
13. "O" ring
14. Center seal
15. Crankpin
16. Crankpin washers
17. Crankpin bearing
18. Connecting rod
19. Piston pin bearing
20. Shim
21. Snap ring
22. Oil seal

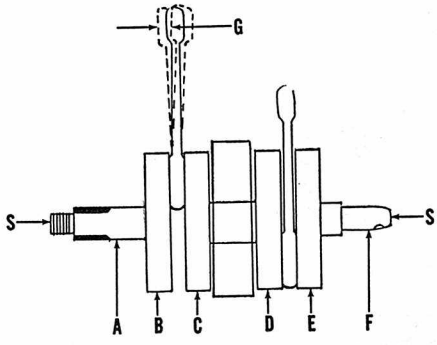


Fig. Y7-15—Refer to text for checking crankshaft for correct assembly or wear.

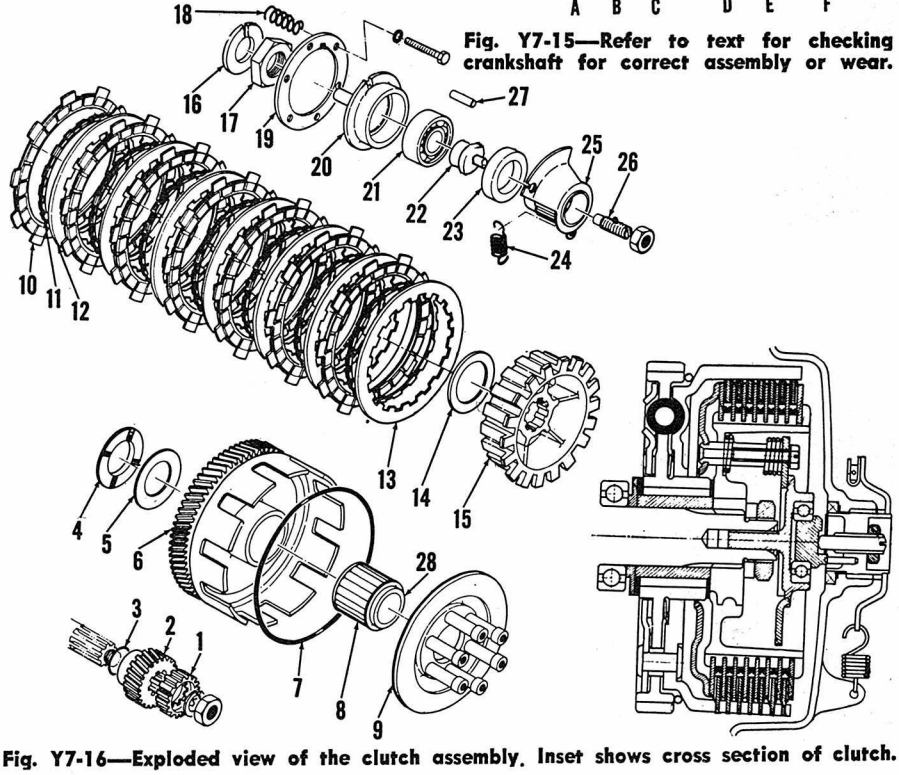


Fig. Y7-16—Exploded view of the clutch assembly. Inset shows cross section of clutch.

1. Oil pump gear
2. Crankshaft primary drive gear
3. "O" ring
4. Thrust plate
5. Thrust washer
6. Clutch drum
7. "O" ring
8. Bearing
9. Pressure plate
10. Friction discs (7 used)
11. Separator rings (7 used)
12. Clutch plates (6 used)
13. Thick clutch plate (1 used)
14. Thrust washer
15. Clutch hub
16. Lock washer
17. Hub nut
18. Clutch spring (6 used)
19. Spring plate
20. Push crown
21. Release bearing
22. Release plug
23. Oil seal
24. Return spring
25. Release lever and screw
26. Adjusting screw
28. Bearing sleeve

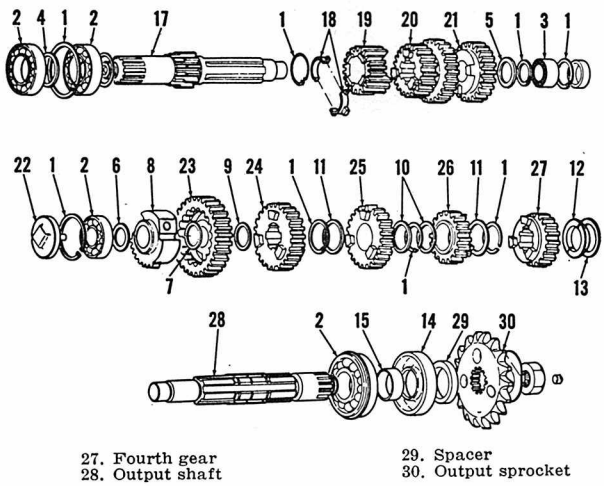


Fig. Y7-19 — Exploded view of transmission. Refer also to Fig. Y7-20.

1. Snap rings
2. Ball bearings
3. Needle bearing
4. Spacer
5. Washer
6. Shim
7. Thrust washer
8. Kick starter pinion
9. Spacer
10. Washers
11. Washers
12. Setting plate
13. Shim
14. Oil seal
15. Collar
17. Input shaft
18. Setting plate
19. Second gear
20. Third & fifth gear
21. Fourth gear
22. Oil catcher
23. First gear
24. Second gear
25. Third gear
26. Fifth gear
27. Fourth gear
28. Output shaft
29. Spacer
30. Output sprocket

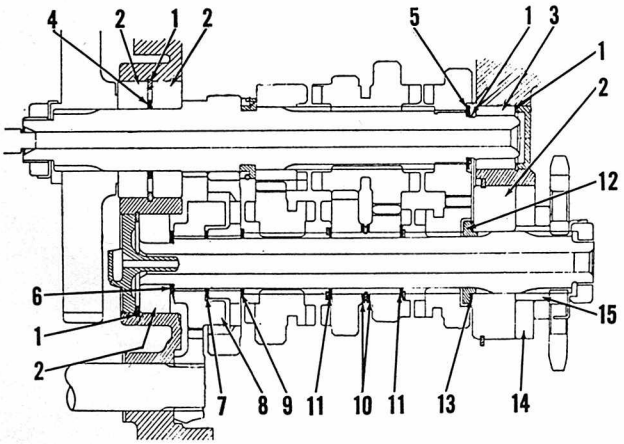


Fig. Y7-20 — Cross sectional view of the transmission assembly showing location of spacers and washers.

1. Snap rings
2. Ball bearings
3. Needle bearing
4. Spacer
5. Washer
6. Shim
7. Thrust washer
8. Kickstarter pinion
9. Spacer
10. Washers
11. Washers
12. Setting plate
13. Shim
14. Oil seal
15. Collar

that rings correctly engage pins in the ring grooves and marks on side of rings are toward top of piston. Pistons should be installed on connecting rods with arrow pointing toward front. Cylinder head stud nuts should be torqued to 180 inch-pounds.

DS6 models are equipped with Keystone type pistons and rings. (Fig. Y 7-13). A standard type piston will not accept Keystone rings and a Keystone type piston will not accept standard type rings. However, a Keystone type piston and rings assembly will work in a standard cylinder. A Keystone piston is identified by a letter "K" stamped in the piston dome. Keystone rings will be marked "1N" or "1T" for top ring and "2N" or "2T" for bottom ring. All ring markings should be toward top of piston.

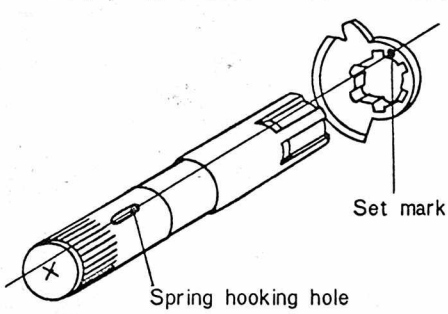


Fig. Y7-21 — Mark on kickstarter gear should be aligned with spring hooking hole as shown.

CONNECTING RODS AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Connecting rods, crankpins, rod bearings and the center main bearings are removed by pressing the crankshaft apart. The crankshaft should be disassembled **ONLY** if required tools are available to correctly check and align the reassembled crankshaft. If side shake (G—Fig. Y7-15) at piston pin end of connecting rod exceeds 0.08 inch (2MM), the connecting rod, crankpin and lower bearing should be renewed. Shake (G) should be 0.032-0.039 inch (0.8-1.0-MM). Side clearance of connecting rod between the crankshaft counter weights can be measured with a feeler gage. Side clearance should be 0.0039-0.012 inch (0.1-0.3MM). With crankshaft supported between lathe centers (S—Fig. Y7-15), maximum eccentricity when measured with dial indicator at points (A & F) should not exceed 0.0012 inch and should not exceed 0.0024 inch at points (B,C,D & E).

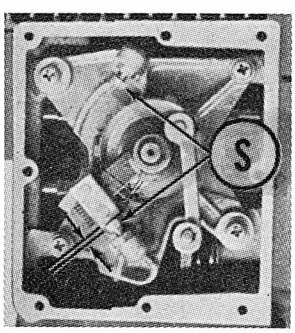


Fig. Y7-22—Gear change stop bolts (S) should have approximately 1MM clearance when stop ball engages detent in shifter cam.

CLUTCH. The clutch is located on the left end of the transmission input shaft and can be removed after removing the engine left side cover.

Clutch friction discs (10—Fig. Y7-16) should be renewed if less than 0.106 inch (2.7MM) thick. Thickness when new is 0.118 inch (3MM). Free length of clutch springs (18) should be 1.73 inches (44MM). Springs should be renewed if less than 1.65 inches (42MM). Inspect all parts for wear, warpage or evidence of overheating. Some 1970 model year DS6-C units were produced with 40 MM clutch springs rather than 44 MM springs that are on all other models. These springs can be replaced with the normal 44 MM version.

Make sure that the clutch drum thrust washers (5 & 14) and bearing sleeve (28) are correctly fit. End play should be 0.002-0.004 inch (0.05-0.1-MM) and is adjusted by varying the thickness of thrust washers (5 & 14). Thrust washers are available in thicknesses of 2.1, 2.2 and 2.3MM. Bearing sleeve (28) should be a thumb press fit without any measurable clearance in bearing. Oversize bearing sleeves are available.

To measure clutch drum end play, it is necessary to carefully measure the total thickness of clutch drum (at position of thrust washers) and thrust washers. Subtract the total thickness from the length of the bearing sleeve (28). If difference (end play) is not within the limits of 0.002-0.004 inch (0.05-0.1MM), it is necessary to install thrust washers (5 & 14) of different thickness. The clutch will not release properly if end play is too tight. On some DS6 models thrust washer (5 & 14) are made of fiber and should be renewed if they appear worn.

Use grease to hold the thrust washers (5 & 14) in position around the bearing sleeve when installing the drum (6), sleeve (28) and thrust washers (5 & 14). Be careful not to twist separator rings (11) when assembling.

CRANKCASE AND GEAR BOX. The kickstarter gear should be in-

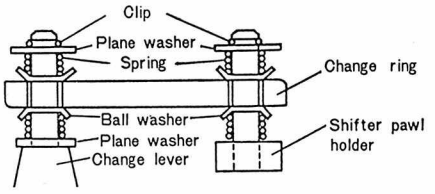


Fig. Y7-23—View of shift change ring installation.

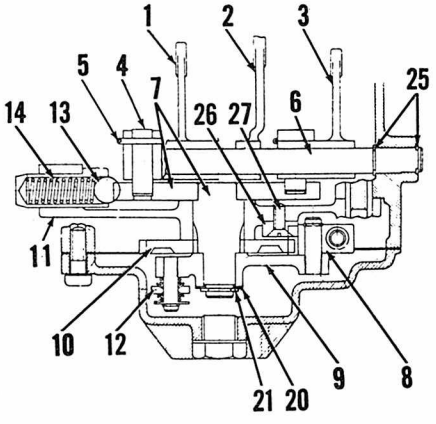
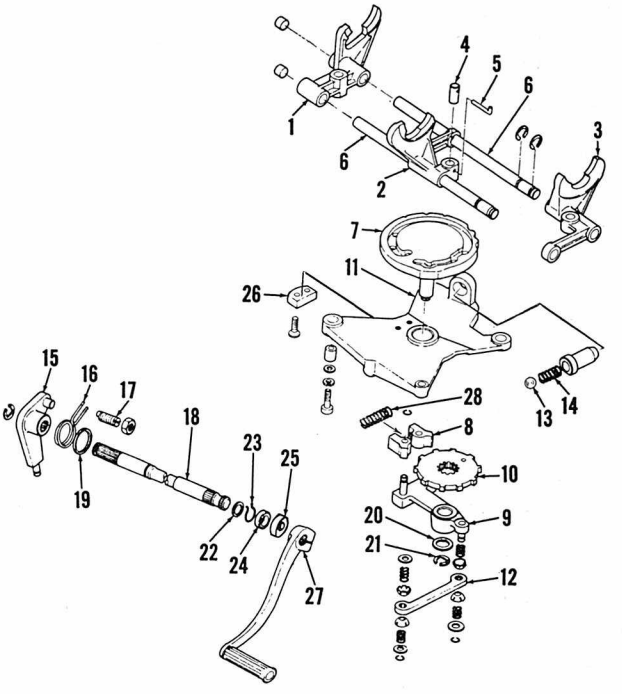


Fig. Y7-24—Cross sectional view of the shift assembly. Refer to Fig. 7-25 for legend.

Fig. Y7-25 — Exploded view of the shift assembly. Shift fork (1) moves gear (26—Fig. Y7-19), fork (2) moves gear (20—Fig. Y7-19) and fork (3) moves gear (24—Fig. Y7-19).

1. Shift fork (5th)
2. Shift fork (2nd & 4th)
3. Shift fork (1st & 3rd)
4. Shift rotor (3 used)
5. Stop pin (3 used)
6. Shift rails
7. Shift cam
8. Shifter pawls
9. Pawl holder
10. Working plate
11. Mounting plate
12. Change link
13. Cam detent ball
14. Detent spring
15. Change lever
16. Return spring
17. Eccentric screw
18. Shift pedal shaft
19. Washer
20. Shims
21. Snap ring
22. Washer
23. Snap ring
24. Oil seal
25. Seal
26. Pawl plate
27. Shift pedal



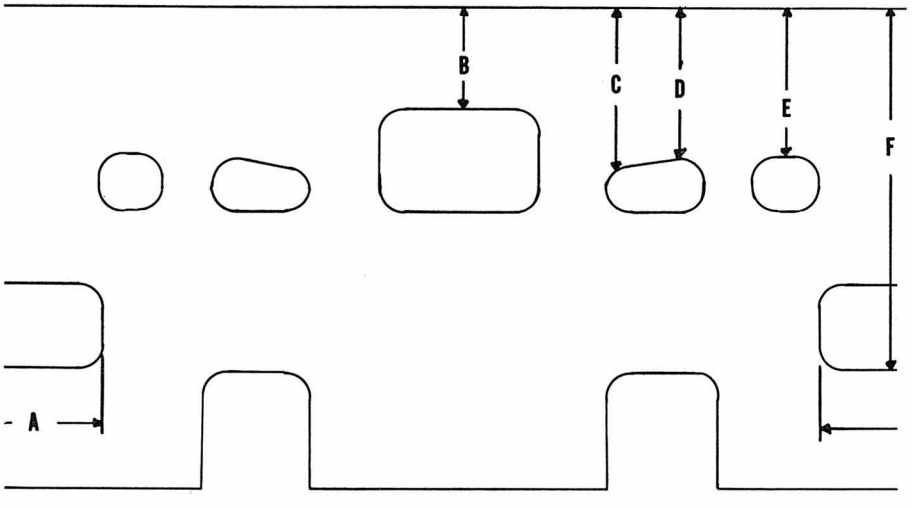


Fig. YT7-1—Cylinder porting of TD-2 road racer may be incorporated into standard DS-6 cylinder. Do not leave any sharp edges protruding into cylinder.

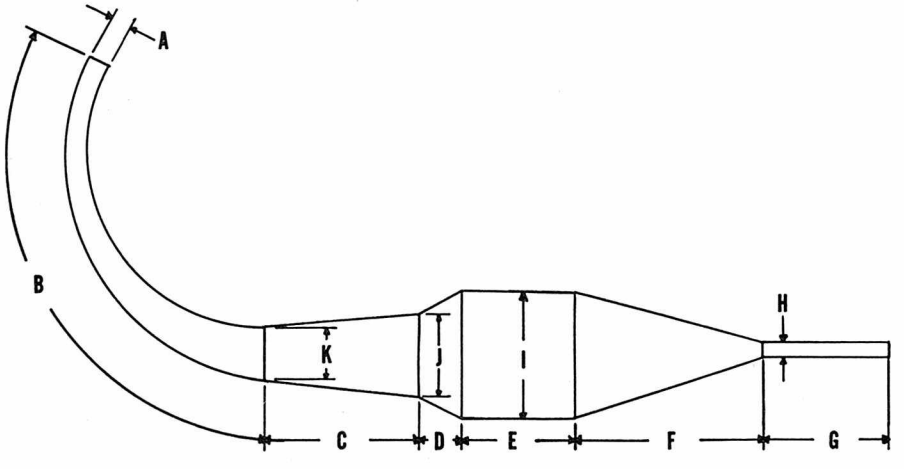


Fig. YT7-2—Basic design of Yamaha TD-2 road racer expansion chamber. Chamber will improve the performance of a correctly modified DS-6 street twin.

stalled on shaft with mark on gear aligned with spring hooking hole as shown in Fig. Y7-21. Shifter stop bolts (S—Fig. Y7-22) should have approximately 1MM(0.04 in.) clearance as the stop ball falls into detent in the cam.

SPEED TUNING

Model YDS-5 is the basis for the TD1-C series production road racers. Features of the TD1-C may be incorporated in YDS-5 models to improve performance.

The TD-2 road racer is based on the DS-6 250cc street twin. The TD-2 specifications in the following paragraphs may be used as a guide in speed tuning the DS-6 models. Any modification of standard parts or installation of performance parts will void manufacturers warranty.

CARBURETORS. The TD-2 is equipped with 30 MM sliding valve Mikuni units.

PISTON, CYLINDER AND HEAD. Standard DS-6 cylinder head may be milled to a capacity of 11.3 cc. Be sure to remachine the taper in edge of combustion chamber.

A TD-2 piston measures 54 MM (2.126 in.) long while a standard DS-6 piston is 63 MM (2.480 in.) long. Metal may be removed from the skirt of the DS-6 piston to meet TD-2 specifications.

The following cylinder porting specifications may be incorporated into a standard DS-6 cylinder. (Refer to Fig. YT7-1)

A. 34 MM (1.338 in.)
B. 25 MM (0.984 in.)
C. 39.5 MM (1.55 in.)
D. 37.5 MM (1.47 in.)
E. 37.5 MM (1.47 in.)
F. 87 MM (3.4252 in.)

EXPANSION CHAMBER. An expansion chamber designed for the TD-2 Daytona road racer will work well on a modified DS-6.

The following specifications were taken from a TD-2 road racer chamber. (See Fig. YT7-2).

A. 42 MM (1.653 in.)
B. 266 MM (10.472 in.)
C. 190 MM (7.48 in.)
D. 45 MM (1.77 in.)
E. 160 MM (6.299 in.)
F. 175 MM (6.889 in.)
G. 175 MM (6.889 in.)
H. 20 MM (0.787 in.)
I. 97 MM (3.818 in.)
J. 80 MM (3.149 in.)
K. 54 MM (2.126 in.)

YAMAHA YR-1, YR-2 AND YR-3 350 CC TWIN CYLINDER MODELS

MODEL	YR-1 YR-2 YR-2C YR-3 R-3
Displacement-cc	348
Bore-MM	61
Stroke-MM	59.6
Number of Cylinders	2
Engine oiling system	"Autolube"
Plug gap-inch	0.020-0.023
Point gap-inch	0.011-0.013
Ignition timing	Automatic advance
Piston position BTDC-inch	0.083
Electrical system voltage	12
Battery terminal grounded	Negative
Tire size-front	3.00x18
Rear	*3.50x18
Tire pressure-front	22
Rear	28**
Rear chain free play-inch	⅝-¾
Number of speeds	5
Weight-lbs. (approx.)	340

*Tire size is 3.25x18 for YR-1 models.
**Tire pressure is 25 PSI for R-3 models.

MAINTENANCE

SPARK PLUGS. Recommended spark plug electrode gap is 0.020-0.023 inch (0.6-0.7MM). Suggested spark plug for normal use is NGK type B9HC. Champion L-5 or L-81 can be used.

CARBURETORS. Two Mikuni VM carburetors are used. Idle speed should be set at approximately 1,200 RPM by turning adjusters (2—Fig. Y8-1). Make sure that throttle slides (7) both stop at exactly the same position and exhaust pressure is the same for both cylinders. Idle mixture is changed by turning needles (11). Initial setting is 1½ turns open. Turning the needle counter-clockwise leans the mixture. Carburetors must be synchronized to open exactly the same amount by turning cable guides (1) on top of each carburetor. To synchronize, begin by turning idle speed adjusters (2) all the way down, then adjust cable guides (1) to begin raising throttle slides at the same time. After carburetors are correctly synchronized, adjust idle speed. Throttle cables must not have any slack (free play) at carburetors, but cable at hand grip should have approximately

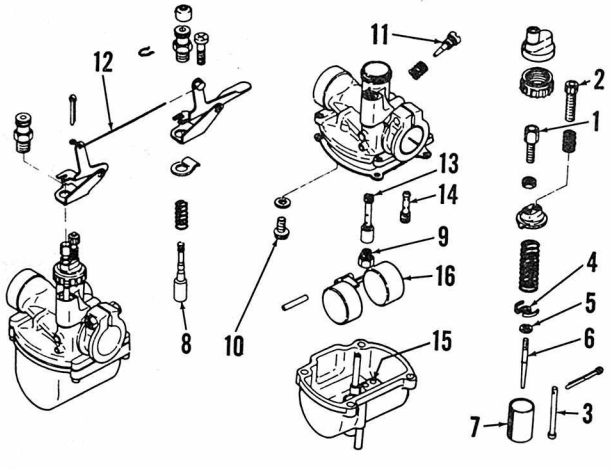


Fig. Y8-1—Exploded view of Mikuni VM carburetor. Starting valves for both carburetors are connected with rod (12).

1. Throttle cable guide
2. Idle speed adjuster
3. Idle speed rod
4. Retainer
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Fuel inlet valve
11. Idle mixture needle
12. Link rod
13. Needle jet
14. Pilot jet
15. Starting jet
16. Float

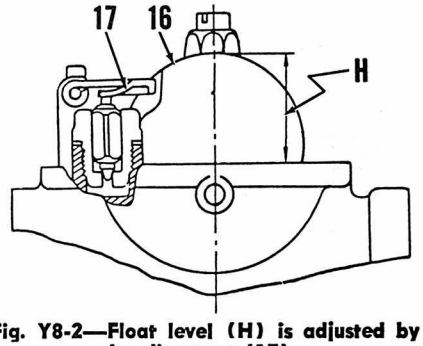


Fig. Y8-2—Float level (H) is adjusted by bending tang (17).

1/16-inch free play. Oil pump control cable should be adjusted after throttle cables are adjusted.

Float level (H—Fig. Y8-2) should be 1 inch (25.5MM) and is adjusted by bending tang (17) on float. Refer to Fig. Y8-1 and the following standard specifications:

Main jet (9) .....#160 or 170
Pilot jet (14) ..... #30
Needle jet (13) 0-2
Valve needle (6) 5D1
Clip (5) in second or third groove from top of needle (6).

IGNITION AND ELECTRICAL. All models are equipped with a battery ignition system with an individual set of breaker points, condenser and coil for each cylinder. The generator is mounted at the left end of the crankshaft and the breaker points are mounted on the generator stator.

Breaker point gap at maximum opening should be 0.011-0.013 inch (0.30-0.35MM). The breaker points should just open when the piston is 0.083 inch (2.1MM) BTDC. Make sure that ignition advance weights are fully extended (out) when checking the timing. Ignition timing must be checked and adjusted individually for each cylinder. A static timing light or meter can be used to indicate point opening and a dial indicator in the spark plug hole to position the piston. Timing is changed by moving the breaker point assembly in the elongated holes after loosening the two mounting screws.

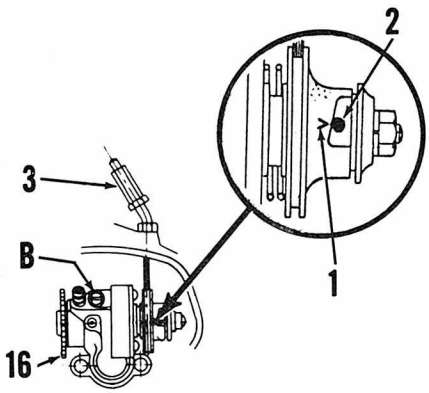


Fig. Y8-5—When carburetor controls are correctly adjusted and engine is at idle speed, mark (1) should be aligned with guide pin (2). Cable adjuster is shown at (3).

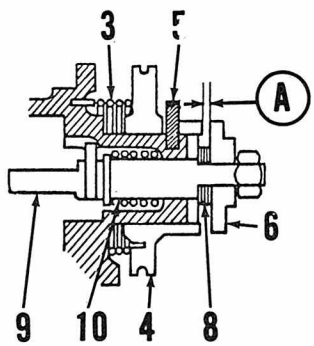


Fig. Y8-7—Clearance (A) is adjusted by varying shims (8).

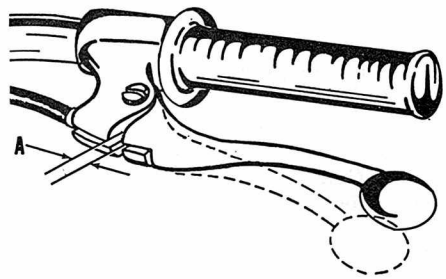


Fig. Y8-9—The clutch hand lever should have $\frac{1}{16}$-$\frac{1}{8}$-inch free play at (A).

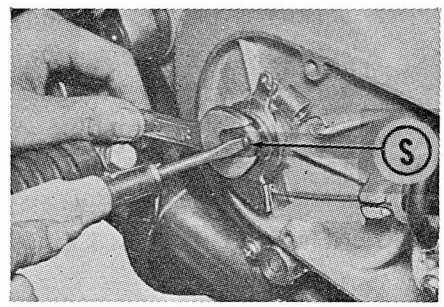


Fig. Y8-10—The clutch adjusting screw (S) is located under the cover on right side of engine.

LUBRICATION. The engine is lubricated by oil contained in a separate tank. A pump and metering unit pumps oil from the tank to each cylinder inlet passage. The oil tank should **never** be allowed to run dry. SAE 30 two-stroke oil should be used. The oil pump control cable should be accurately adjusted to provide the correct amount of oil. If the cable adjustment is incorrect, the engine may be damaged.

Before adjusting the pump control cable, it is important that the throttle cable guides (1—Fig. Y8-1) are correctly set. To adjust the throttle cable guides, turn the idle speed adjusters (2) all the way down, then sychronize cable guides (1) so that both throttle slides (7), begin to move at exactly the same time when the hand grip is turned. The throttle cables should have approximately $\frac{1}{16}$-inch free play after they are sychronized. Adjust the idle speed to 1,100-1,300 RPM by turning both idle adjusters (2). Make certain that both throttle slides stop at exactly the same time. Turn the throttle hand grip just enough to take up free play from the throttle cables (without changing idle speed) and check the oil pump setting mark and guide pin as shown in Fig. Y8-5. If the mark (1) is not exactly aligned with guide pin (2); loosen the lock nut and turn the pump cable adjuster (3) as required to align.

Check the minimum plunger stroke by turning starter plate (16) until clearance (A—Fig. Y8-7) between pulley and adjusting plate is at minimum. Clearance (A) should be 0.20-0.25MM (0.0079-0.0098 inch). If clearance is incorrect, add or deduct shims (8).

If oil lines are drained or pump is removed, it is important that all lines be filled before starting engine. Remove bleeder screw (B—Fig. Y8-5) and pull the control cable up out of cable guide (3). Turn starter plate (16) until oil without air bubbles flows from the bleeder screw hole, then reinstall bleeder screw (B) and start engine. Run engine at idle speed until oil delivery lines (20—Fig. Y8-6) are free of air bubbles.

The gear box contains 1¼ quarts of SAE 10W/30 or 20W/40 motor oil and should be drained and refilled every 2000 miles.

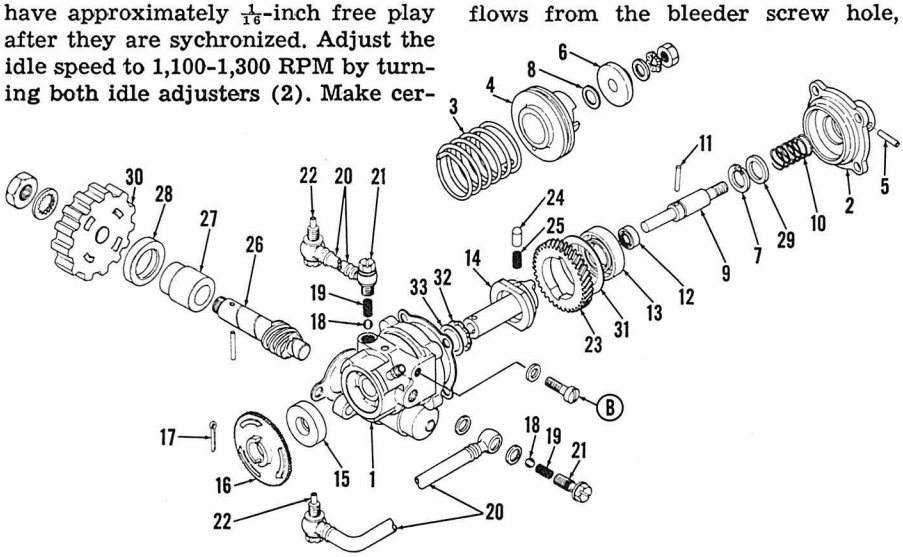


Fig. Y8-6—Exploded view of the oil injection pump unit.

1. Pump case
2. Cover
3. Pulley spring
4. Adjust pulley
5. Guide pin
6. Adjust plate
7. Snap ring
8. Shims
9. Plunger
10. Plunger return spring
11. Cam guide pin
12. Plunger oil seal
13. Plunger cam oil seal
14. Distributor
15. Oil seal
16. Starter plate
17. Drive pin
18. Check balls
19. Springs
20. Delivery pipes
21. Banjo bolts
22. Injector bolt
23. Worm wheel
24. Worm wheel pin
25. Spring
26. Worm shaft
27. Bushing
28. Oil seal
29. Spring seat
30. Drive gear
31. Worm wheel plate
32. Wave washer
33. Plate

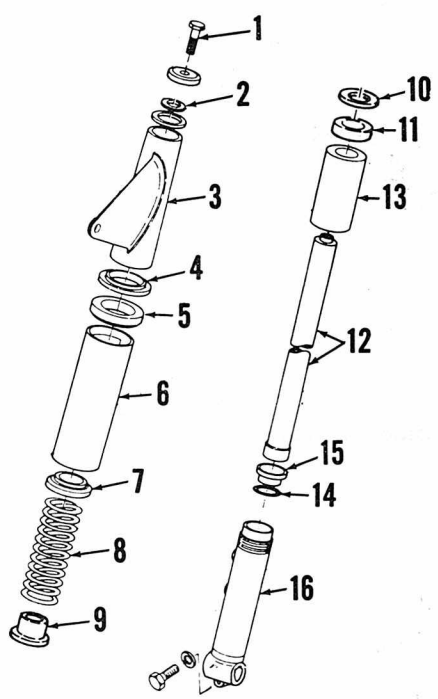


Fig. Y8-12—Exploded view of the front suspension system used on YR-1 and YR-2 models.

1. Filler screw
2. Seal
3. Cover
4. Guide
5. Gasket
6. Cover
7. Spring seat
8. Spring
9. Spring seat
10. Washer
11. Oil seal
12. Inner tube
13. Tube nut
14. "O" ring
15. Bushing
16. Lower tube

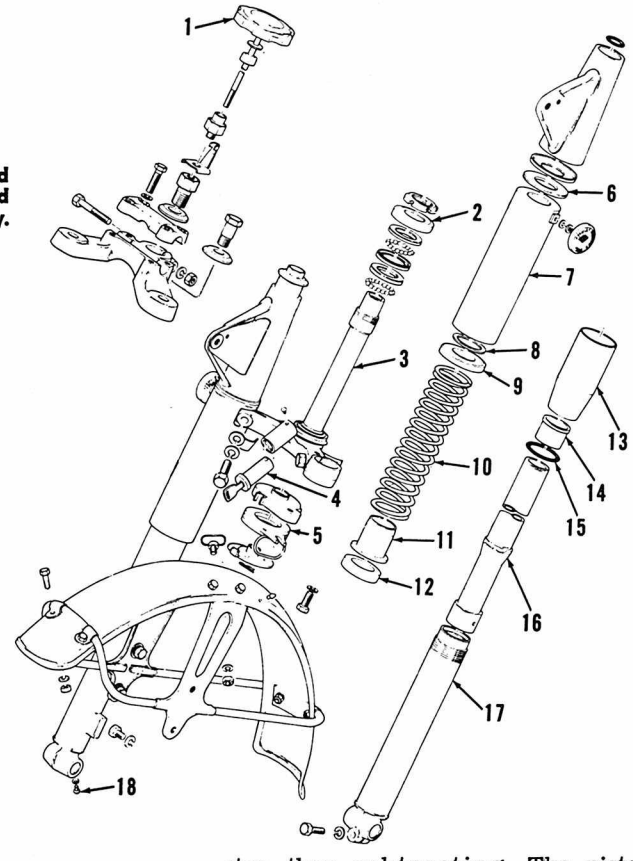


Fig. Y8-13 — Exploded view of R3 steering and front suspension assembly.

1. Steering damper handle
2. Ball race cover
3. Steering stem assembly
4. Fork lock
5. Damper friction plates
6. Packing
7. Cover
8. Upper spring washer
9. Upper spring seat
10. Fork spring
11. Lower spring seat
12. Oil seal
13. Outer tube nut
14. Metal slider
15. "O" ring
16. Inner tube
17. Outer tube
18. Oil drain plug

CLUTCH CONTROLS. The clutch hand lever should have $\frac{1}{16}$-⅛ inch free play at (A—Fig. Y8-9). To adjust, remove the cover from right side of engine and loosen lock nut. Turn the adjusting screw (S—Fig. Y8-10) in until slight resistance is felt, then back screw out ¼ turn and tighten lock nut. Turn the cable guide at hand lever end of cable until the hand lever free play (A—Fig. Y8-9) is correct.

SUSPENSION. Each front suspension unit contains 240cc of multigrade SAE20W/40 engine oil. Oil should be renewed every 2,000 miles.

REPAIRS

PISTONS, RINGS AND CYLINDERS. Each piston can be removed after removing exhaust pipe, carburetor, cylinder head and cylinder. Refer to the following specifications:

Ring end gap .....0.006-0.014 inch
Ring side clearance in groove—
Top ring .....0.0016-0.0032 inch
Second ring .....0.0012-0.0028 inch
Standard cylinder bore
diameter .....61MM (2.4 inches)
Maximum cylinder bore taper or
out of round .....0.002 inch
Piston skirt to cylinder
clearance .....0.0012-0.0014 inch

Piston skirt clearance in cylinder bore should be measured by first measuring piston diameter at right angles to piston pin and cylinder bore diameter, then subtracting. The piston should be measured 10MM (0.4 inch) above bottom edge of skirt. Make sure that rings correctly engage pins in the ring grooves and marks on side of rings are toward top of piston. Pistons should be installed on connecting rods with arrow pointing toward front. Cylinder head stud nuts should be torqued to 180 inch-pounds.

CONNECTING RODS AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Refer to Fig. Y8-21. Connecting rods, crankpins rod bearings and the center main bearings and seal are removed by pressing the crankshaft apart. The crankshaft should be disassembled **ONLY** if required tools are available to cocrrectly check and align the reassembled crankshaft. If side shake (G—Fig. Y8-15) at piston pin end of connecting rod exceeds 0.08 inch (2MM), the connecting rod, crankpin and lower bearing should be renewed. Shake (G) should be 0.032-0.039 inch (0.8-1.0MM). Side clearance of connecting rod between the crankshaft counter weights can be measured with a feeler gage. Side clearance should b 0.0039-0.012 inch (0.1-0.3MM). With crankshaft supported between lathe centers (S—Fig. Y8-15), maximum eccentricity when measured with a dial indicator at points (A & B) should not exceed 0.0006 inch (0.015MM).

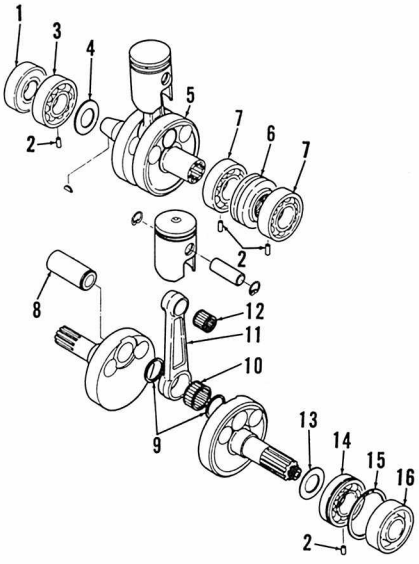


Fig. Y8-14—Exploded view of the crankshaft assembly.

1. Oil seal
2. Dowel pins
3. Left main bearing
4. Shims
5. Crankshaft left cylinder half
6. Center seal
7. Center main bearings
8. Crankpin
9. Crankpin washers
10. Crankpin bearing
11. Connecting rod
12. Piston pin bearing
13. Shim
14. Right main bearing
15. Snap ring
16. Oil seal

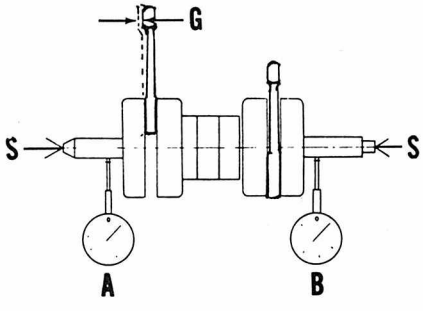


Fig. Y8-15—Refer to text for checking crankshaft for correct assembly or wear.

When reinstalling crankshaft, make certain that the holes in all four main bearing outer races correctly engage the locating dowels (D—Fig. Y8-16) in the top crankcase half. Snap ring on right main bearing outer race should be installed so that open space between ends of snap ring is aligned

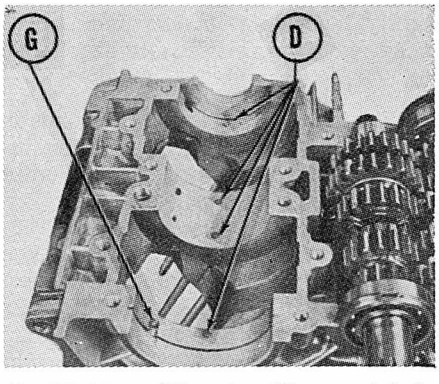


Fig. Y8-16 — When installing crankshaft, make certain that dowels (D) engage holes in all four main bearing outer races. Align open space of snap ring (15—Fig. Y8-14) with oil groove (G).

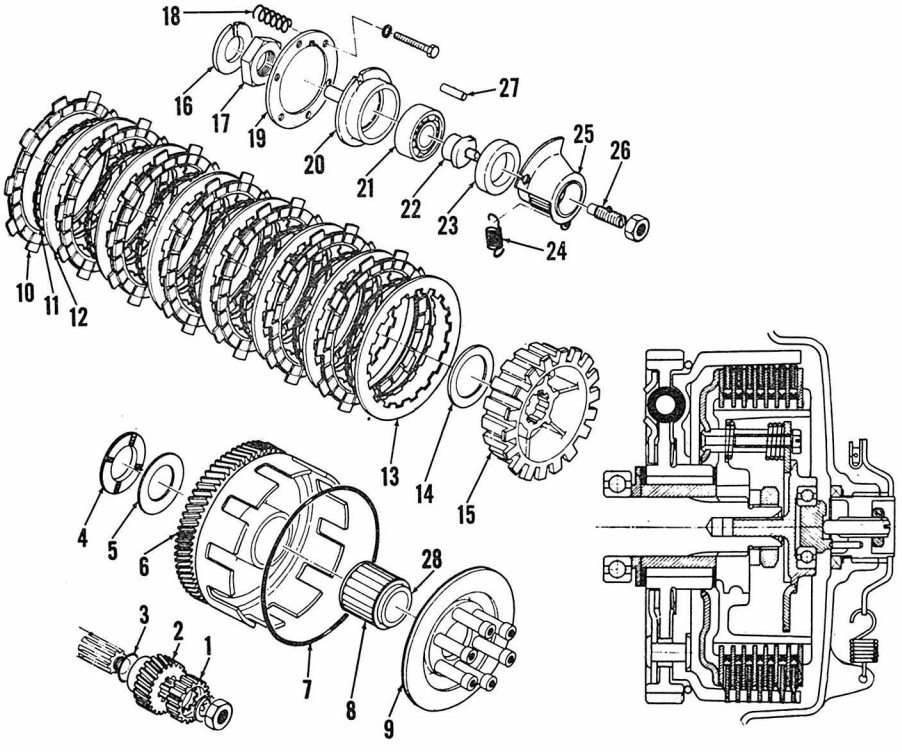


Fig. Y8-17—Exploded view of the clutch assembly. Unit is mounted on right end of transmission input shaft and is driven by the crankshaft primary drive gear (2).

1. Oil pump gear
2. Crankshaft primary drive gear
3. "O" ring
4. Thrust plate
5. Thrust washer
6. Clutch drum
7. "O" ring
8. Bearing
9. Pressure plate
10. Friction discs (7 used)
11. Separator rings (7 Used)
12. Clutch plates (6 used)
13. Thick clutch plate (1 used)
14. Thrust washer
15. Clutch hub
16. Lock washer
17. Hub nut
18. Clutch spring (6 used)
19. Spring plate
20. Push crown
21. Release bearing
22. Release plug
23. Oil seal
24. Return spring
25. Release lever and screw
26. Adjusting screw
28. Bearing sleeve

with the oil groove (G) in the top crankcase half. The oil seal on left end of crankshaft should be installed flush with the crankcase surface. The oil seal on the right end of crankshaft should be installed so that edge of seal contacts the outer race of main bearing. Yamaha bond No. 5 or equivalent sealer should be applied evenly to the complete mating surfaces of crankcase halves. Install the lower half making sure that screws are torqued in the sequence stamped on lower half. The 6MM screws should be tightened to 87 inch-pounds torque and the 8MM screws should be torqued to 174 inch-pounds.

CLUTCH. The clutch is located on the right end of the transmission input shaft and can be removed after removing the engine right side cover.

Clutch friction discs (10—Fig. Y8-17) should be renewed if less than 0.106 inch (2.7MM) thick. Thickness when new is 0.118 inch (3MM). Free length of clutch springs (18) should be 1.43 inches (36.4MM). Springs should be renewed if less than 1.39 inches (35.4MM). Inspect all parts for wear, warpage or evidence of overheating.

Make sure that the clutch drum thrust washers (5 & 14) and bearing sleeve (28) are correctly fit. End play should be 0.002-0.004 inch (0.05-0.1MM) and is adjusted by varying the thickness of thrust washers (5 & 14). Thrust washers are available in thicknesses of 2.1, 2.2 and 2.3MM. Bearing sleeve (28) should be a thumb press fit without any measurable clearance in bearing. Oversize bearing sleeves are available.

To measure clutch drum end play, it is necessary to carefully measure the total thickness of clutch drum (at position of thrust washers) and thrust washers. Subtract the total thickness from the length of the bearing sleeve (28). If difference (end play) is not within the limits of 0.002-0.004 inch (0.05-0.1MM), it is necessary to install thrust washers (5 & 14) of different thickness. The clutch will not release properly if end play is too tight.

Use grease to hold the thrust washers (5 & 14) in position around the bearing sleeve when installing the drum (6), sleeve (28) and thrust washers (5 & 14). Be careful not to twist separator rings (11) when assembling.

CRANKCASE AND GEAR BOX. To separate the crankcase halves, first remove the generator and output sprocket from left side. Remove the clutch assembly and the oil pump and primary drive gears from the right side of engine. Remove the sealing boot (3 Fig. Y8-19), snap ring (4), shims (5) and washer (6) from the left end of the gear change shaft, then remove the change shaft and linkage from the right side of engine. Remove the shift detent (13) and retainer plate (15). Remove kick starter spring guide (4—Fig. Y8-20) and return spring (5). Turn the crankcase assembly upside down, remove the attaching screws and carefully separate the crankcase halves. The gears and shafts

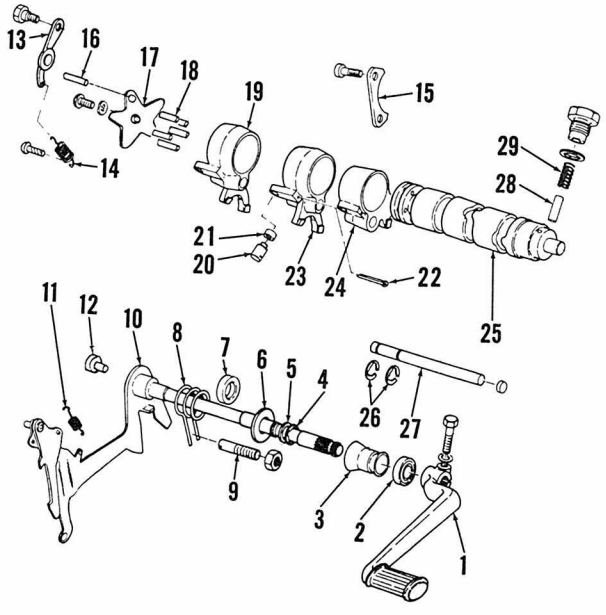


Fig. Y8-19 — Exploded view of the gear shift assembly. Shift fork (19) moves gear (27—Fig. Y8-22), fork (23) moves gear (8—Fig. Y8-22) and fork (24) moves gear (20—Fig. Y8-22).

1. Shift pedal
2. Seal
3. Sealing boot
4. Snap ring
5. Shims
6. Washer
7. Oil seal
8. Return spring
9. Eccentric screw
10. Change shaft
11. Ratchet spring
12. Plug
13. Detent
14. Detent spring
15. Shift drum retainer plate
16. Change pin (long)
17. Side plate
18. Change pins
19. Shift fork (5th)
20. Guide pin (3 used)
21. Roller (3 used)
22. Cotter pin (3 used)
23. Shift fork (2nd & 4th)
24. Shift fork (1st & 3rd)
25. Shift drum
26. Snap rings
27. Shift fork rail
28. Neutral detent
29. Detent spring

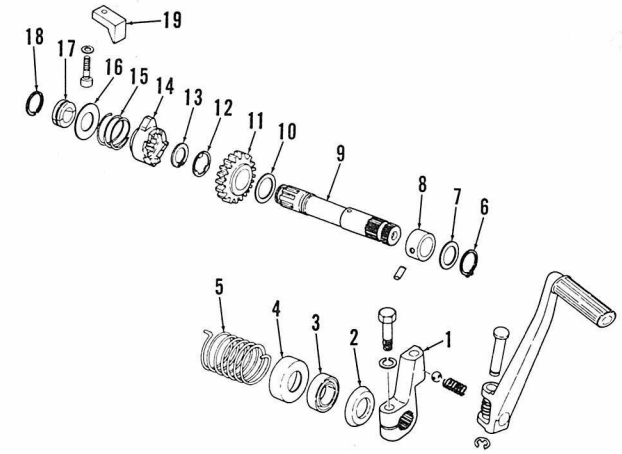


Fig. Y8-20 — Exploded view of the kick starter assembly. Gear (11) meshes with first gear (19 —Fig. Y8-22).

1. Starter lever
2. Cover
3. Oil seal
4. Spring guide
5. Return spring
6. Snap ring
7. Shim
8. Bushing
9. Pedal shaft
10. Wave washer
11. Starter gear
12. Washer
13. Snap ring
14. Ratchet
15. Ratchet spring
16. Washer
17. Holder (2 halves)
18. Snap ring
19. Stop

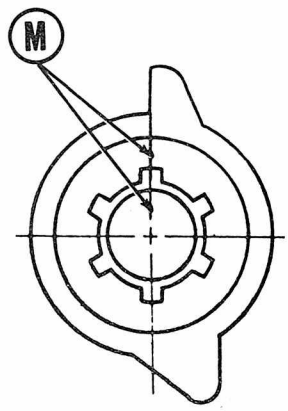


Fig. Y8-24—Align marks (M) on ratchet (14—Fig. Y8-20) and shaft (9) when assembling.

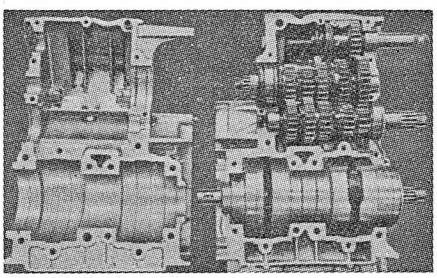


Fig. Y8-21—Gears and shafts should stay in place in the top half of crankcase when the lower half is lifted off.

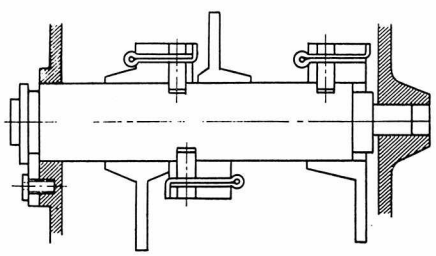


Fig. Y8-23—When installing the shift drum and forks, install cotter pins through guide pins in direction shown. Be sure that forks do not touch cotter pins.

should remain in place in the top half as shown in Fig. Y8-21.

When assembling, make sure that cotter pins for the guide pins are installed in direction shown in Fig. Y8-23 and do not touch shift forks. Marks on end of kick starter ratchet and pedal shaft should be aligned as shown in Fig. Y8-24. Install the crankcase lower half making sure that screws are tightened in sequence stamped on lower half. The 6MM screws should be tightened to 87 inch-pounds torque and the 8MM screws should be torqued to 174 inch pounds. Adjust position of eccentric screw (S—Fig. Y8-25) until clearance (C) between shift ratchet and shift pins is the same.

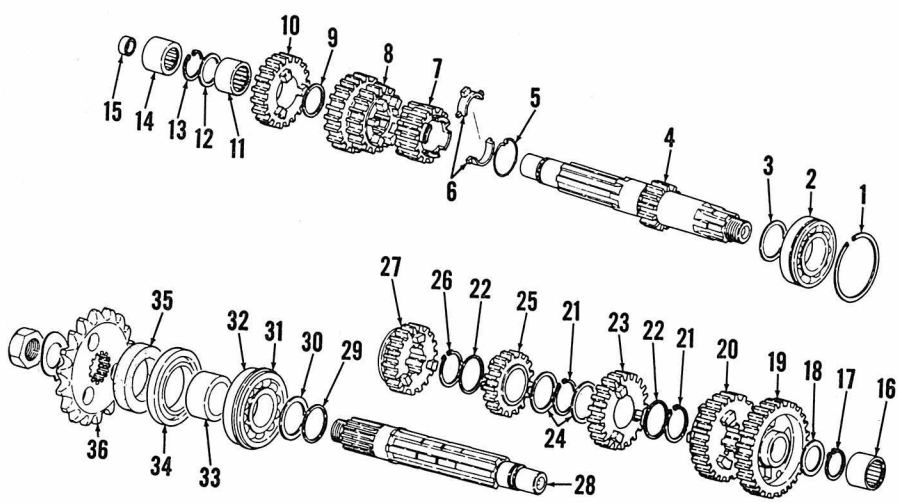


Fig. Y8-22—Exploded view of the transmission assembly. Refer to Fig. Y8-21 for view of parts installed in the top half of crankcase.

1. Snap ring
2. Bearing
3. Shim
4. Input shaft and first gear
5. Clip
6. Gear setting plate
7. Second gear
8. Sliding gear (3rd & 5th)
9. Washer
10. Fourth gear
11. Gear bearing
12. Washer
13. Snap ring
14. Shaft bearing
15. Plug
16. Bearing
17. Snap ring
18. Washer
19. First gear
20. Sliding gear (2nd)
21. Snap rings
22. Washer
23. Third gear
24. Washers
25. Fifth gear
26. Snap ring
27. Sliding gear (4th)
28. Output shaft
29. Shim
30. Shim
31. Snap ring
32. Bearing
33. Collar
34. Oil seal
35. Felt dust seal
36. Output sprocket

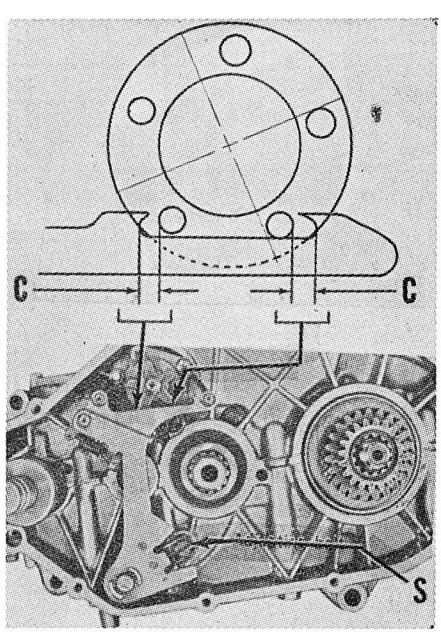


Fig. Y8-25—Turn the eccentric screw (S) until clearance (C) is the same on each side of shift drum pins.

YAMAHA R3 RR ROAD RACER

MODEL	R3 RR
Displacement-cc	348
Bore-MM	61
Stroke-MM	59.6
Number of cylinders	2
Oil-Fuel ratio	1:20*
Plug gap-inch	0.020-0.024
Point gap-inch	0.009-0.012
Ignition timing	Fixed
Piston position BTDC-inch	0.078
Tire size-Front	3.00x18
Rear	3.00x18
Tire pressure-Front	25.6 PSI**
Rear	28.5 PSI**
Number of speeds	5
Weight-Lbs. (approx.)	253

*Use a 1:20 mix in fuel tank in addition to automatic oil metering system.

**Dry track tire pressures are given. Recommended pressures for wet track operation are 24.2 PSI in front tire and 27.0 PSI in rear tire.

The R3 RR is a factory prepared road racing version of the R3 series street twins. General repair and adjustment procedures for the R3 apply to R3 RR models except for the details in the following paragraphs.

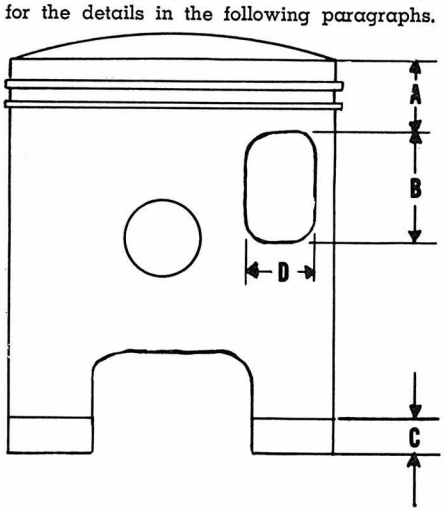


Fig. YT8-1—Drawing of standard R3 piston showing locations of comparison with road racing R3 RR piston.

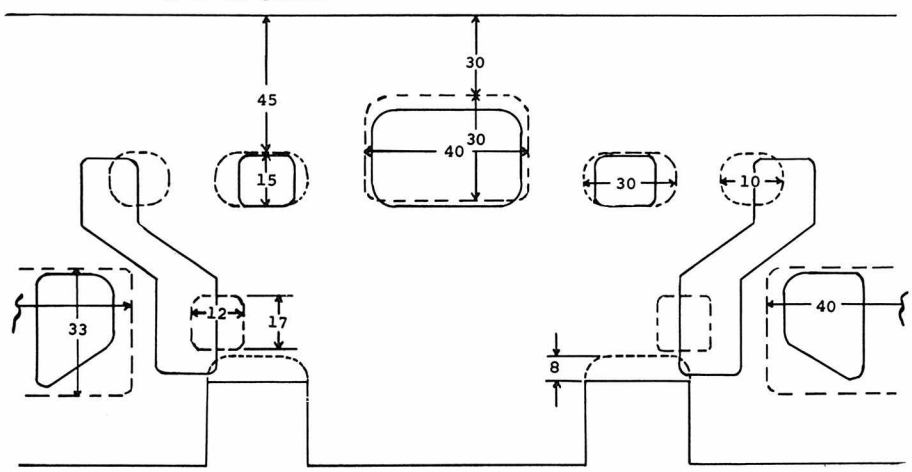
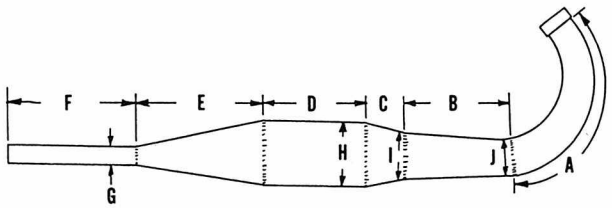


Fig. YT8-2—Comparison of R3 and R3 RR cylinder porting. All dimensions are in MM.

Fig. YT8-3 — Diagram of expansion chamber used on an R3 RR road racer. Refer to text for dimensions.



SPARK PLUG AND IGNITION. Recommended spark plug for extended high speed operation is NGK type B-10EN or equivalent. An NGK type B-7E or B-8EN should be used to warm engine up.

Ignition should occur when piston is 2.0 MM (0.078 inch) BTDC. Set breaker points to maximum gap of 0.009-0.012 inch. Turn entire breaker assembly base plate to adjust timing.

CARBURETORS. The R3 RR is equipped with two VM 34 SC units with the following specifications:

Main jet	#320-400 #380 Std.
Needle jet	0-6
Jet needle	6 F 5
Throttle valve	1.5
Pilot jet	#60

Jet needle clip in second groove from top of needle. Pilot air screw initially set 1½ turns out from a lightly seated position.

Carburetors should be carefully inspected to make certain that throttle slides are at equal heights in slide bores at full throttle position.

LUBRICATION. The automatic oil metering system is retained but it is not affected by throttle position. Pump is secured to the full stroke position and only engine RPM will vary the amount of oil pumped. In addition to oil injection, a 20:1, fuel to oil mixture should be used in the fuel tank. A gasoline with an octane rating of 100 or better is recommended. Although not recommended, if oil pump is removed a 12:1 fuel to oil mixture should be used in fuel tank.

PISTON, CYLINDER AND CYLINDER HEAD. A standard R3 RR cylinder head has a capacity of 16.3 cc.

Pistons in the R3 RR are 6 MM (0.236 inch) shorter in the skirt (C—Fig. YT8-1) than R3 models. Port in piston is 14.5 MM (0.57 inch) from top edge of piston (A); 21 MM (0.826 inch) high and 12 MM (0.47 inch) wide. Only one piston ring is used in racing models.

Instead of the transfer grooves in cylinders of street models, the R3 RR has actual ports cast into the all alloy cylinder. A comparison of the R3 RR and standard R3 cylinder may be seen in Fig. YT8-2. Solid lines represent porting of street model cylinder.

EXPANSION CHAMBER. An expansion chamber similar to the one used on R3 RR models may be constructed with the following specifications (Fig. YT8-3): (All dimensions in inches)

A. 11	F. 7
B. 8	G. ¾
C. 2	H. 3¾
D. 6¼	I. 3¼
E. 7	J. 2¼

SUSPENSION. Front suspension units on the R3 RR require 215cc of 10W/30 motor oil each.

CLUTCH. Standard free length of clutch springs is 44 MM (1.732 inch) on R3 RR models. Renew springs if less than 43 MM (1.692 inch) long.

YAMAHA DT-1 AND RT-1 SINGLE ENDURO MODELS

Model	DT-1	RT-1
Displacement-cc	246	351
Bore-MM	70	80
Stroke—MM	64	70
Number of cylinders	1	1
Oil-fuel ratio	Oil Injection	Oil Injection
Plug gap-inch	0.020-0.024	0.020-0.024
Point gap-inch	0.012-0.015	0.012-0.015
Ignition timing	Fixed	Auto-Advance
Piston position BTDC-inch	0.126	0.133 (Advanced)
Tire size- front	3.25x19	3.25x19
Rear	4.00x18	4.00x18
Tire pressure (psi)-front	12-14*	13**
Rear	16-18*	16**
Rear chain free play-inch	¾-⅞	1
Number of speeds	5	5
Weight-lbs. (Approx.)	232	258

*For trail riding, tire pressure should be 10 psi for front, 12 rear.

**For trail riding, tire pressure should be 8.5 PSI for front, 10 PSI rear.

MAINTENANCE

SPARK PLUG. Recommended spark plug for normal use in 250cc models is NGK type B-7E or equivalent. Recommended spark plug for normal use in 360cc models is NGK type B-9E or equivilant. Spark plug electrode gap should be 0.020-0.024 inch (0.5-0.6MM).

CARBURETOR. Both models are equipped with flange mounted Mikuni sliding valve carburetors. Throttle cable should have 0.02-0.04 inch (0.5-1.0 MM) free play at idle position. Pilot air screw (1—Fig. Y9-1 or Y9-2) should be 1½ turns out from a lightly seated position. Idle speed should be adjusted after allowing engine to reach normal operating temperature. Turn idle speed adjuster (2—Fig. Y9-1 or Y9-2) to obtain an idle of 1400-1500 RPM for 360cc models and 1200-1400 RPM for 250cc models.

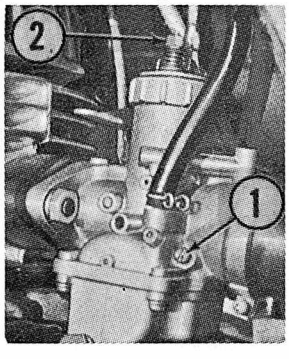


Fig. Y9-1—View of the carburetor used on early 250cc models. Idle mixture is adjusted at needle (1) and idle speed at adjuster (2).

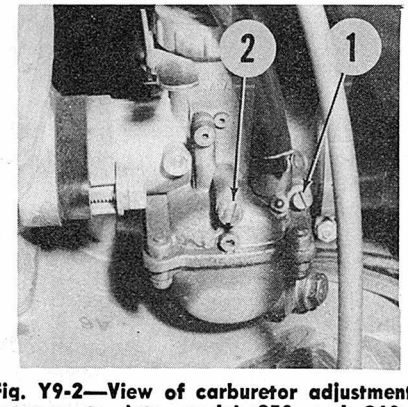


Fig. Y9-2—View of carburetor adjustments common to late model 250 and 360cc units.

Float level (H—Fig. Y9-3) should be 14.1MM ($\frac{9}{16}$ inch) on most models and 15.8 MM (⅝ inch) on DT-1E models. Make certain that "O" ring is in good condition before installing float chamber.

Refer to the following and Fig. Y9-4 for typical carburetor specifications:

DT-1 (VM 26 SH)

Main jet (9)	#160*
Needle jet (13)	0-2
Valve needle (6)	5 D 1
Pilot jet (14)	#35
Throttle valve (7)	2.5

Clip (5) in third groove from top of needle (6).

* DT-1 models before engine serial number 2921 did not have expanders behind piston rings and were equipped with #150 main jets. All flat type replacement piston rings have expander rings and a #160 main jet should be installed.

RT-1 (VM 32 SH)

Main jet (9)	#220-#240*
Needle jet (13)	0-4
Valve needle (6)	6 DP 1*
Pilot jet (14)	#30
Throttle valve (7)	1.5

*Some RT-1 models were equipped with a 6 CF 1 valve needle to smooth engine performance. If this needle is used a #230-#240 main jet is recommended and pilot air screw (1—Fig. Y9-2) should be 1¾ turns out.

Clip (5) in fourth groove from top of 6 DP 1 needle and second groove from top of 6 CF 1 needle.

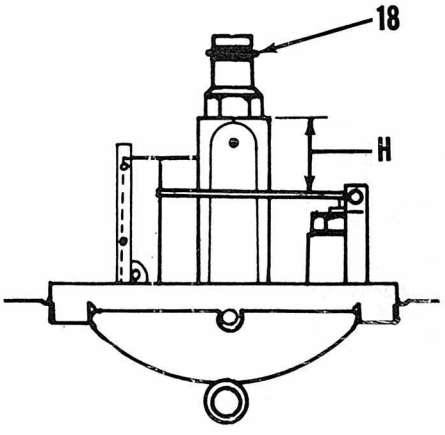


Fig. Y9-3 — Make certain that "O" ring (18) is in perfect condition before installing float bowl.

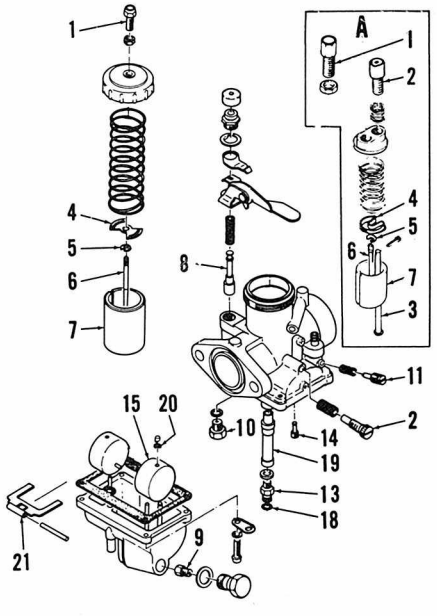


Fig. Y9-4—Exploded view of carburetor. Inset (A) is idle speed adjustment used on early DT-1 units.

1. Cable guide
2. Idle speed adjuster
3. Idle speed stop rod
4. Retainer
5. Clip
6. Valve needle
7. Throttle slide
8. Starting valve
9. Main jet
10. Fuel inlet valve
11. Idle mixture needle
13. Needle jet
14. Pilot jet
15. Floats
18. "O" ring
19. Main nozzle
20. Clips
21. Float lever

IGNITION AND ELECTRICAL. All models are equipped with a 6V 2AH battery mounted beneath the seat. A single wave rectifier, also beneath seat, is used to convert AC current to

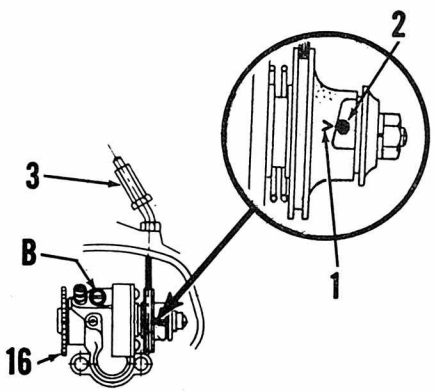


Fig. Y9-5—When carburetor controls are correctly adjusted and engine is at idle speed, mark (1) should be aligned with guide pin (2). Cable adjuster is shown at (3).

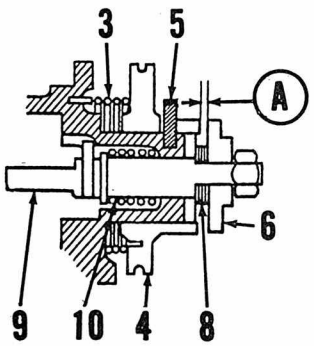


Fig. Y9-6—Clearance (A) should be 0.020-0.25MM and is adjusted by varying shims (8).

DC for battery charging, horn and brake light.

Ignition breaker point gap should be 0.012-0.015 inch at maximum opening. Ignition should occur (points just open) when piston is 3.2 MM (0.126 inch) BTDC on DT-1 models. Ignition should occur when piston is 3.4 MM (0.133 inch) BTDC on RT-1 models. When checking ignition timing on RT-1 models it is necessary to secure advance mechanism flyweights to the full open position. A dial gage may be used after removing the cylinder head.

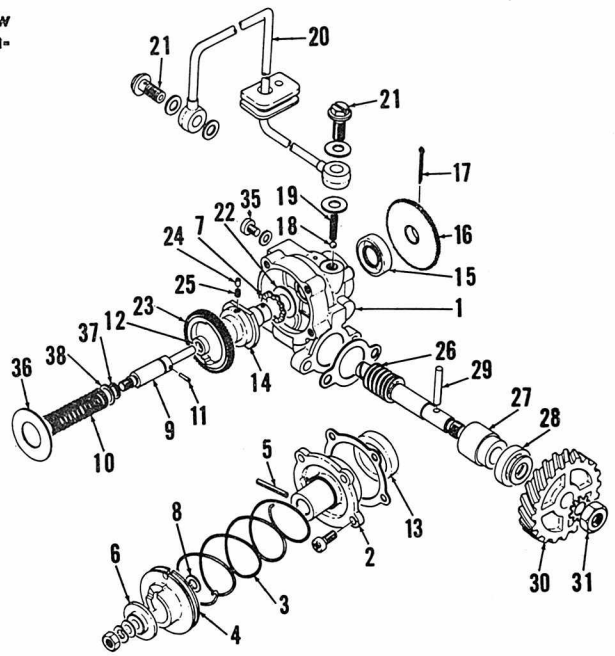
Mark on rotor can normally be aligned with pointer on stator when crankshaft is in correct position for ignition.

LUBRICATION. Oil contained in a separate tank is pumped into the inlet passage to lubricate the engine. The oil tank should be filled with SAE 30 two-stroke oil and should never be allowed to run dry.

If the "Autolube" system is drained or the pump unit is renewed, the air should be bled from the system as follows: Remove screw (B—Fig. Y9-5) from bleeder hole, pull control cable up out of the guide (3) and turn starter plate (16) until oil without air bubbles flows from bleeder screw hole. Reinstall bleeder screw, then

Fig. Y9-7—Exploded view of the "Autolube" oil injection pump.

1. Pump body
2. Cover
3. Pulley spring
4. Pulley
5. Guide pin
6. Adjust plate
7. Wave washer
8. Shims
9. Plunger
10. Plunger return spring
11. Plunger pin
12. Plunger oil seal
13. Plunger cam oil seal
14. Distributor
15. Distributor oil seal
16. Starter plate
17. Drive pin
18. Check ball
19. Check valve spring
20. Delivery pipe
21. Banjo bolts
22. Thrust plate
23. Worm wheel
24. Worm wheel pin
25. Spring
26. Worm shaft
27. Worm shaft bushing
28. Oil seal
29. Pin
30. Drive gear
31. Nut
35. Bleeder screw
36. Plate
37. Snap ring
38. Spring seat



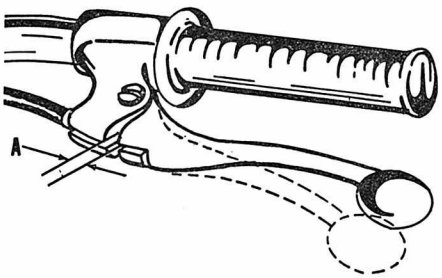


Fig. Y9-8—Clutch hand lever should have $\frac{1}{16}$-$\frac{1}{8}$ inch free play at (A). Refer to text for adjustment.

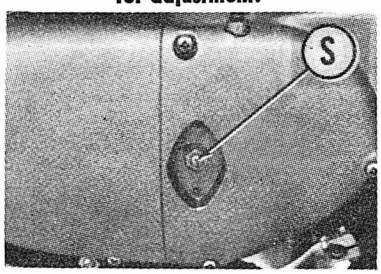


Fig. Y9-9—Clutch adjusting screw (S) is located under small plate on left side of engine. Make certain that lock nut is tightened after adjustment is complete.

start engine and run at idle speed while pulling pump cable up until the oil delivery line is completely free of air bubbles. If bubbles cannot be removed from the pressure line, check for leaking pump seals or inlet oil line.

The pump must be correctly adjusted to provide the correct amount of oil for proper lubrication. Adjustment should be checked every 2,000 miles. To adjust, proceed as follows: Check the plunger minimum stroke by turning the starter plate (16) until clearance between pulley and adjusting plate is at its minimum, then measure clearance (A—Fig. Y9-6) with a

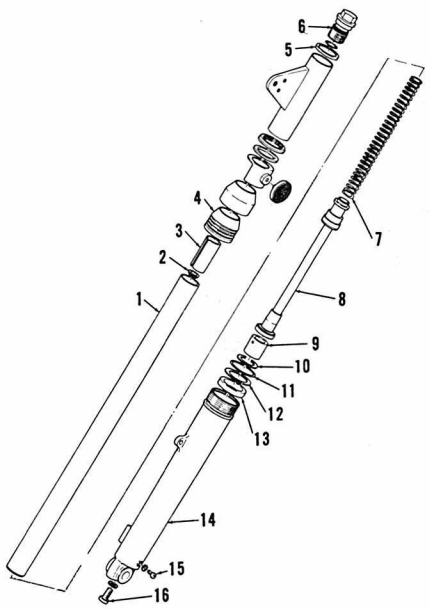


Fig. Y9-10—Exploded view of late DT-1 front suspension unit. Early models had similar construction. Holding bolt (16) must be removed to disassemble unit.

1. Inner fork tube
2. Upper spring seat
3. Spacer
4. Dust seal
5. Upper cover guide
6. Cap bolt
7. Fork spring
8. Damper valve
9. Piston
10. Snap ring
11. Oil seal clip
12. Oil seal washer
13. Oil seal
14. Outer fork tube
15. Oil drain plug
16. Holding bolt

feeler gage. If clearance is not within limits of 0.008-0.010 inch (0.20-0.25MM), vary the number of shims (8). Turn the throttle hand grip just enough to take up free play from the throttle cables (without changing idle speed) and check the oil pump setting mark and guide pin as shown in Fig. Y9-5. If the mark (1) is not exactly aligned with guide pin (2), loosen the lock nut and turn the pump cable adjuster (3) as required to align.

1. Cap bolt
2. "O" ring
3. Cover guide
4. Packing
5. Dust seal
6. Washer
7. Oil seal
8. Outer tube nut
9. "O" ring
10. Metal slide
11. Spacer
12. Upper spring seat
13. Inner tube
14. Piston rings
15. Fork spring
16. Damper valve
17. Outer tube
18. Holding bolt

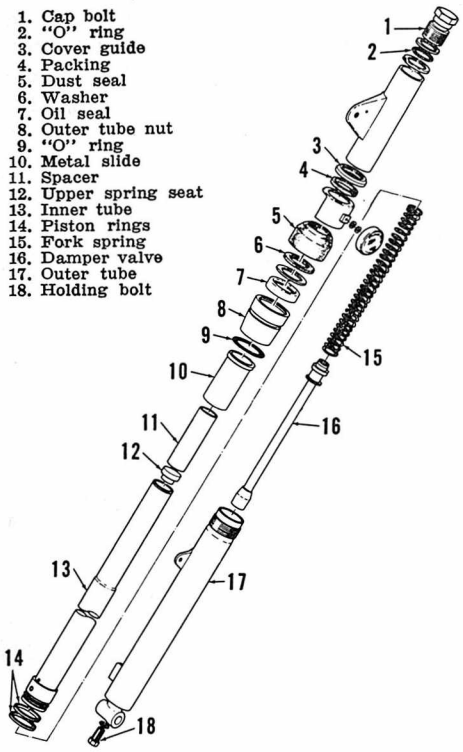


Fig. Y 9-11—Front suspension unit typical of RT-1 models.

SAE 10W/30 engine oil should be used in the gear box. Capacity is one quart. Gear box should be drained and filled with new oil every 1200 miles.

CLUTCH CONTROLS. The clutch hand lever should have $\frac{1}{16}$-⅛ inch (2-3MM) free play at (A—Fig. Y9-8). To adjust, remove the small plate from engine left side cover. Loosen the lock nut and turn the adjusting screw (S—Fig. Y9-9) in until slight resistance is felt, then back the screw out ¼ turn and tighten lock nut. Adjust the cable guide at hand lever end to provide the correct amount of free play at (A—Fig. Y9-8).

SUSPENSION. The DT-1 front suspension units contain 175cc and the RT-1 units contain 210cc of oil each. Oil used should be SAE 10W/30 engine oil.

REPAIRS

PISTON, RINGS AND CYLINDER. The piston can be removed after removing the exhaust pipe, carburetor, cylinder head and cylinder. Piston skirt to cylinder clearance should be 0.0016-0.0018 inch (0.040-0.045 MM) on DT-1 models; 0.0018-0.0020 inch (0.045-0.050 MM) on RT-1 models. Out of round and taper should not exceed 0.015 inch on all models. Ring end gap should be 0.008-0.015 inch for DT-1 models; 0.012-0.020 inch for RT-1 models.

Fig. Y9-12 — Cross sectional view of the clutch assembly. Make certain that thrust washers (1 & 2), bearing (3) and spacer (4) are correctly positioned before tightening nut (16).

S. Adjusting screw
1. Thrust washer (small O.D.)
2. Thrust washers (large O.D.)
3. Thrust bearing
4. Spacer
5. Kickstarter gear
6. Crankshaft (primary drive) gear
7. "O" ring
8. Clutch drum
9. Pressure plate
10. Clutch release plunger
11. Release rods (2 used)
12. Driver plates
13. Separator rings
14. Friction discs
15. Spacer
16. Nut
17. Clutch hub

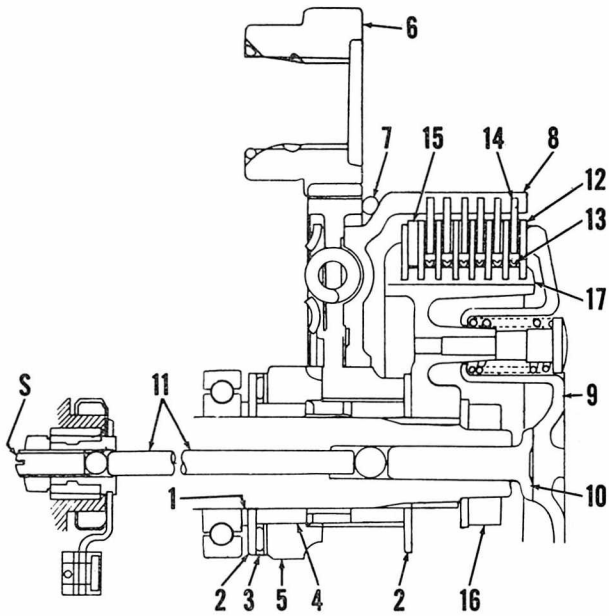
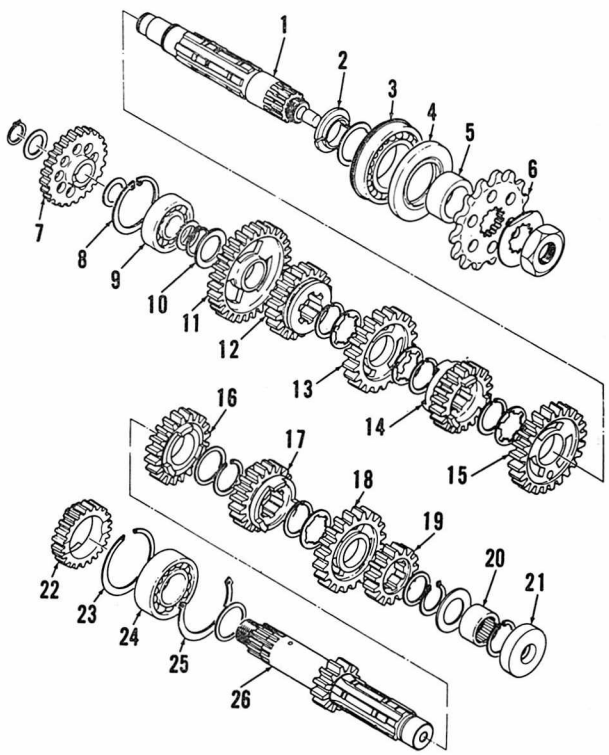


Fig. Y9-13—Exploded view of transmission common to all models.

1. Drive shaft
2. Drive shaft spacers
3. Ball bearing
4. Oil seal
5. Spacer
6. Drive sprocket
7. Idler gear
8. Retaining clip
9. Ball bearing
10. Gear holding washer
11. First gear wheel
12. Fourth gear wheel
13. Third gear wheel
14. Third pinion gear
15. Second gear wheel
16. Fourth pinion gear
17. Third pinion gear
18. Third gear wheel
19. Second pinion gear
20. Bearing
21. Oil seal
22. Kick pinion
23. Retaining clip
24. Ball bearing
25. Retaining clip
26. Counter shaft



NOTE: DT-1 models before engine serial number 2921 did not have expanders behind piston rings and were equipped with #150 main jets. Replacement piston ring sets for early pistons are equipped with expander rings and should have a #160 main jet installed.

Standard and Keystone type rings have been used. Rings are not interchangeable between the two types of pistons. Keystone pistons can be identified by the letter "K" stamped on top of piston. Keystone type ring marked "1N" or "1T" should be installed in top groove. Keystone ring marked "2N" or "2T" should be installed in second groove. Marks on all types of piston rings should be toward top of pistons. Make certain that arrow on top of piston points toward front. Cylinder and head retaining stud nuts should be torqued to 28-33 ft.-lbs.

Late RT-1 models are equipped with a decompression valve to aid in engine starting. If valve is suspected of being faulty it may be checked by removing the valve cover and squirting oil onto the valve with engine running. If oil is sucked in or blown off, check for the following; bent valve stem, maladjusted cable, carbon on valve seat or valve not completely screwed into head.

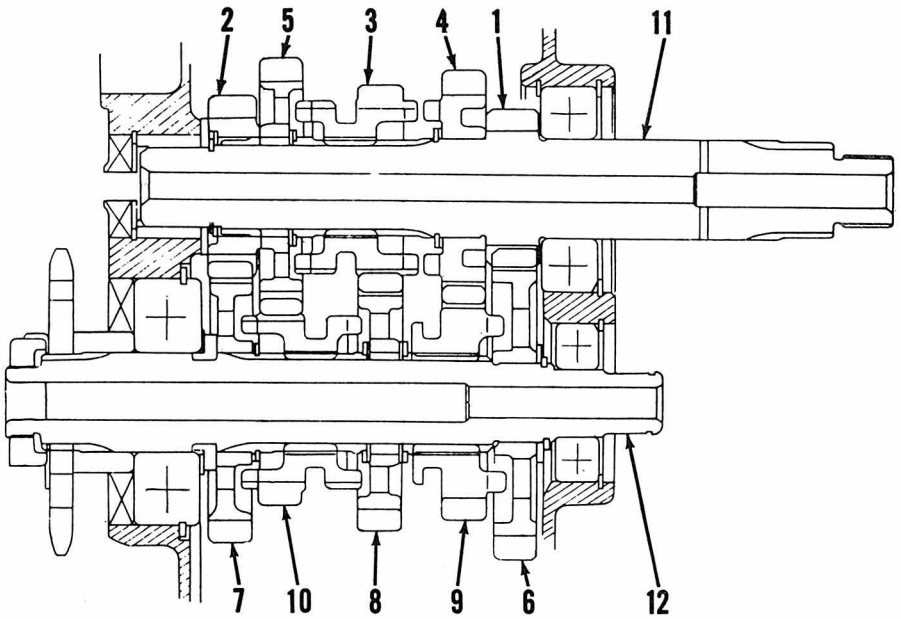


Fig. Y9-14—Cross sectional view of the five speed transmission used on DT-1 and RT-1 models.

1. First gear
2. Second gear
3. Sliding gear (3rd)
4. Fourth gear
5. Fifth gear
6. First gear
7. Second gear
8. Third gear
9. Sliding gear (4th)
10. Sliding gear (5th)
11. Input shaft
12. Output shaft

CONNECTING ROD AND CRANKSHAFT. The crankcase halves must be separated to remove the crankshaft. Connecting rod, crankpin and roller bearing are removed by pressing crankshaft apart. Crankshaft should be disassembled only if required tools are available to correctly check and align the reassembled crankshaft. If the connecting rod side shake at piston pin end exceeds 2MM (0.079 inch), the connecting rod, crankpin and lower end bearing should be renewed. The crankshaft eccentricity should be less than 0.03MM (0.0012 inch) when measured at main bearing journals with crankshaft supported between lathe centers. Connecting rod side clearance between crankshaft counter weights should be 0.016-0.020 inch (0.4-0.5MM).

CLUTCH. The clutch is located on the right end of the transmission input shaft and can be removed after removing the engine right side cover. Inspect all parts for wear, warpage or evidence of overheating. Free length of a clutch spring is 1.433 inch (36.4 MM). Replace the springs if they are 0.04 inch shorter than standard. When assembling, make certain that clutch drum thrust washers (1&2—Fig. Y9-12), thrust bearing (3) and spacer (4) are correctly installed. Spacer (15) is replaced with a friction disc on RT-1 models.

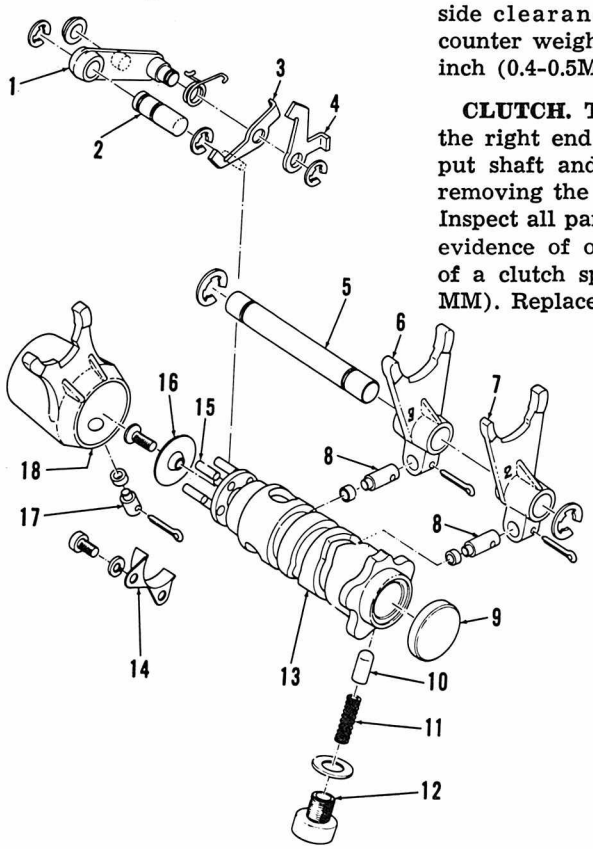


Fig. Y9-15 — Exploded view of shift components used in DT-1 and RT-1 models.

1. Change lever bracket
2. Bracket axle
3. Change lever
4. Change lever
5. Shift fork guide bar
6. Shift fork
7. Shift fork
8. Shift fork guide pins
9. Blind plug
10. Cam stopper
11. Cam stopper spring
12. Cam stopper plug
13. Shift cam
14. Change lever guide
15. Dowel pins
16. Side plate
17. Shift fork guide pin
18. Shift fork

CRANKCASE AND GEAR BOX. The crankcase halves can be separated after removing the engine from the frame. Remove the piston, clutch, magneto, crankshaft primary drive gear, output sprocket and shift linkage. Remove the kickstarter idler gear from the right side, then remove the screws attaching crankcase halves together. Carefully separate the halves.

The shifter assembly and transmission assembly must be installed as a unit. The transmission must also be in the neutral position.

SPEED TUNING

Both DT-1 and RT-1 models are available in competition versions (MX models). Basically these models are standard units with lighting equipment removed and specialized "GYT" kit parts installed.

Repairs and adjustments are identical to standard models with the exceptions listed in the following paragraphs.

Many features of MX models may be incorporated in standard parts for an increase in power. Any modification of standard parts or installation of performance parts will void the manufacturers warranty.

SPARK PLUG AND IGNITION. Recommended spark plug for the DT-1 MX is an NGK type B-10EN or equivalant. An NGK type B-9EN is recommended for use in RT-1 models with the "GYT" kit installed.

Ignition should occur when piston is 2.3 MM (0.091 inch) BTDC on DT-1 MX models and 3.4 MM (0.133 inch) BTDC on RT-1 MX units.

Standard magneto may be retained. Remove all unnecessary wiring and connect black wire from magneto to orange lead of ignition coil and ground positive lead of ignition coil.

CARBURETOR. It has been determined that the following carburetor specifications provide satisfactory performance in DT-1 MX models.

VM 30 SH

Main jet ..... #210-230
Needle jet 0-4
Pilot jet ..... #80
Throttle valve 3.5
Jet needle ..... 5 D 5

Clip in third groove from top of jet needle. Pilot air screw ½-1 turn out from a lightly seated position.

The following specifications have proven to be a workable combination for RT-1 MX models:

VM 34 SH

Main jet	#280
Jet needle	6 DP 1
Needle jet	P-O
Throttle valve	1.5
Pilot jet	#40

Clip in third groove from top of jet needle. Pilot air screw 1¼ turns out from a lightly seated position.

LUBRICATION. Automatic oil metering system is used on MX models. For added lubrication needs such as flat track racing, a 30:1 fuel to oil mixture should be used in fuel tank as well as the oil injection system.

If the oil metering system is removed a mixture of 15 parts gasoline to 1 part oil should be used in the fuel tank.

SUSPENSION. The weight and amount of oil used in front suspension units may be varied to tailor front fork action. Amount of oil used should be from 210-220 cc in each fork tube.

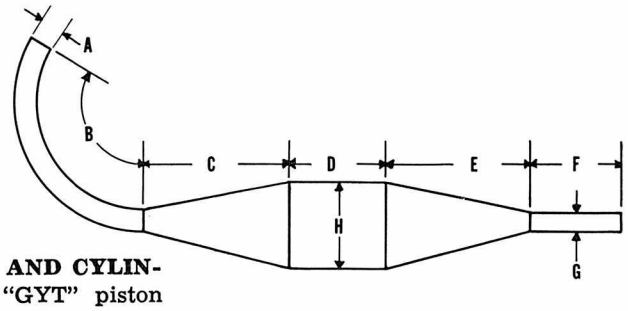


Fig. YT9-1—Refer to text for DT-1 expansion chamber dimensions.

PISTON, CYLINDER AND CYLINDER HEAD. A DT-1 "GYT" piston has 4 MM (0.157 inch) shorter skirt than standard and transfer cutaways in side are also 4 MM higher than standard. "GYT" piston uses only one piston ring.

A standard DT-1 cylinder head has combustion chamber capacity of 37.5 cc. A DT-1 MX cylinder head has a capacity of 27.5cc.

Refer to the following for standard and "GYT" cylinder timing specifications:

	DT-1	DT-1 MX	RT-1	RT-1 MX
INTAKE OPEN—DEGREES BTDC	80	91	80	79
EXHAUST OPEN—DEGREES ATDC	94	91	98	94
TRANSFER OPEN—DEGREES ATDC	123	124	125	121

EXPANSION CHAMBER. MX models are equipped with expansion chambers. An expansion chamber designed to increase performance in DT-1 models may be constructed with the following dimensions: (Fig. YT 9-1) All dimensions are in inches.

A. 1¾	E. 9 13/16
B. 13	F. 10
C. 11	G. 1
D. 7⅞	H. 3¾

YAMAHA HT-1, AT-1 AND CT-1 SINGLE ENDURO MODELS

MODEL	HT-1	AT-1	CT-1
Displacement-cc	89	123	171
Bore-MM	50	56	66
Stroke-MM	45.6	50	50
Number of cylinders	1	1	1
Oil-fuel ratio	Oil-Injection		
Plug gap-inch	0.020-0.024		
Point gap-inch	0.012-0.015		
Ignition timing	Fixed	Auto	Fixed
Piston position BTDC-inch	0.07		
Electrical system voltage	6	12	6
Battery terminal grounded	Negative		
Tire Size-front	2.75x18	3.00x18	3.25x18
Rear	3.00x18	3.25x18	3.50x18
Tire pressure-front	22 PSI	14 PSI	14 PSI
Rear	29 PSI	17 PSI	17 PSI
Rear chain free play-inch	0.8	1.0	0.8
Number of speeds	5	5	5
Weight-lbs. (approx.)	187	221	211

MAINTENANCE

SPARK PLUG. Recommended plug gap is 0.020-0.024 inch. Recommended spark plug for the HT-1 is the NGK type B-8HC. The CT-1 and AT-1 require a NGK type B-8E plug.

CARBURETORS. A Mikuni VM type carburetor is used on all models. Idle mixture screw (1—Fig. Y10-1) should be 1½ turns out from a lightly seated position on CT-1 and AT-1 models. Screw (1—Fig. Y10-2) should be 1¾ turns out on HT-1 models. Float level is adjusted by bending tang (B—Fig. Y10-3) and is measured from top of float to gasket surface of float bowl. Float level should be 0.88 inch on HT-1 and 1.0 inch on CT-1 annd AT-1 models. Refer to the following specifications for standard sizes:

CT-1 and AT-1

See Fig. Y10-1.

Main jet (2)	#150
Needle jet (8)	N-8
Jet needle (4)	4D3
Pilot jet (5)	#30
Idle speed	1200-1300 RPM

Clip (6) in third groove from top of needle (4).

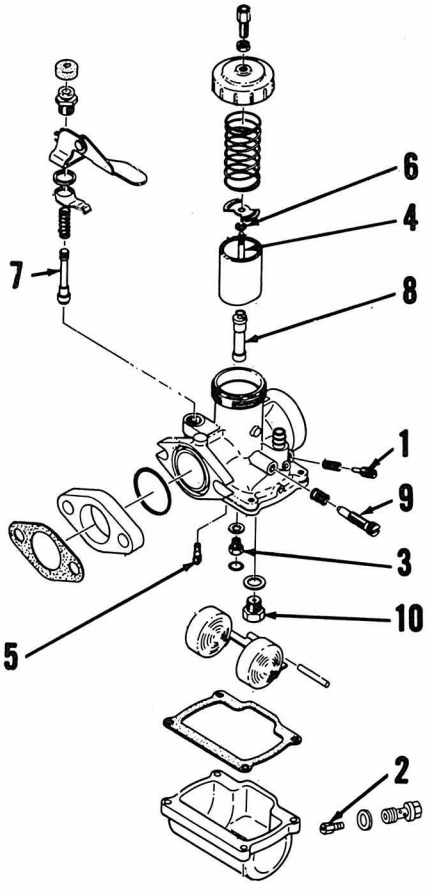


Fig. Y10-1—Exploded view of typical carburetor used on AT-1 and CT-1 models.

1. Pilot air screw
2. Main jet
3. Needle jet setter
4. Jet needle
5. Pilot jet
6. Jet needle clip
7. Starter plunger
8. Needle jet
9. Throttle screw
10. Valve seat assembly

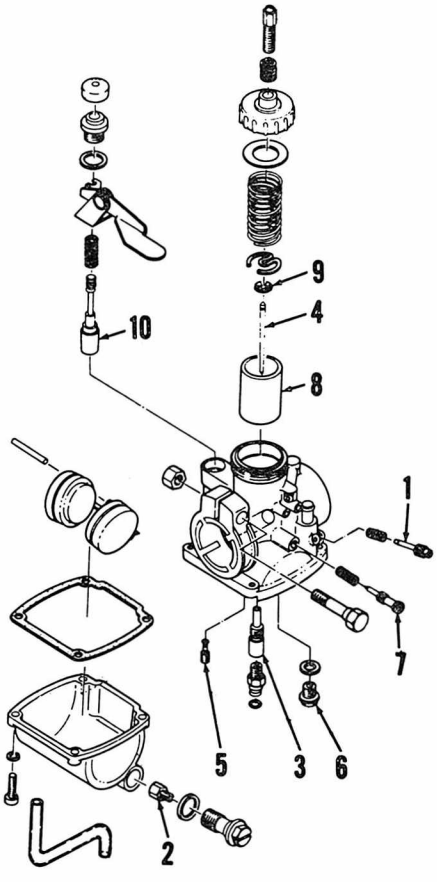


Fig. Y10-2—Exploded view of carburetor used on HT-1 models.

1. Pilot air screw
2. Main jet
3. Needle jet
4. Jet needle
5. Pilot jet
6. Valve seat assembly
7. Throttle screw
8. Throttle slide
9. Jet needle clip
10. Starter plunger

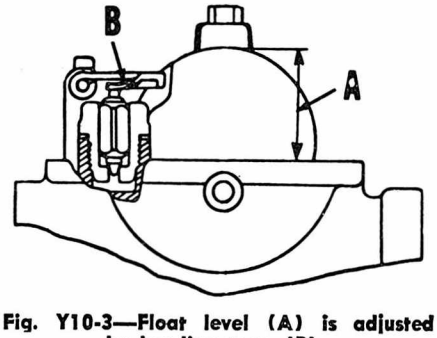


Fig. Y10-3—Float level (A) is adjusted by bending tang (B).

Fig. Y10-4—A bent spoke (3) can be used to hold points open. Timing marks (1&2) should be lined up so that future timing checks can be made without the aid of a dial gage.

HT-1

See Fig. Y10-2

Main jet (2)	#85
Needle jet (3)	N-6
Jet needle (4)	4D3
Pilot jet (5)	#30
Idle speed	1350-1450 RPM

Clip (9) in third groove from top of needle (4).

IGNITION AND ELECTRICAL. The AT-1 is equipped with a combination start motor-DC generator. The CT-1 and HT-1 have a flywheel magneto. The spark plug must be removed and a dial gage installed to time the engine. Bring piston to TDC position and set gage to zero and then back the crankshaft up past 0.07 inch BTDC then move it forward to 0.07 inch BTDC. Ignition points should just be opening at this time. On AT-1 models it is necessary to wedge the governor flyweights open during the timing operation. See Fig. Y10-4. Maximum point gap should be set at 0.012-0.015 for all models.

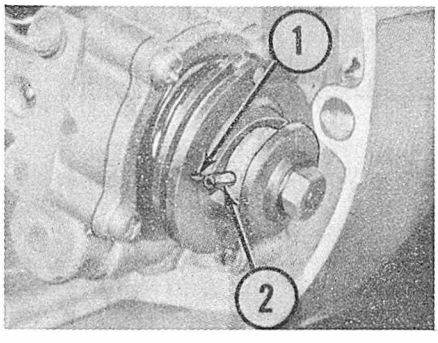


Fig. Y10-5—Mark (1) and guide pin (2) should line up with engine at idle.

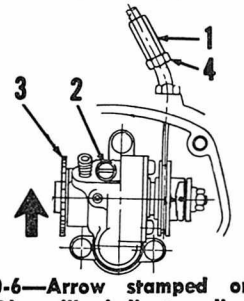


Fig. Y10-6—Arrow stamped on starter plate (3) will indicate direction of rotation.

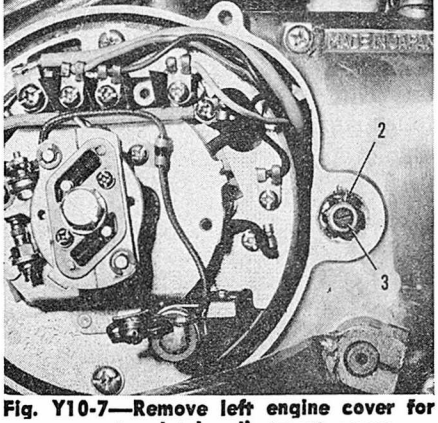


Fig. Y10-7—Remove left engine cover for access to clutch adjustment screw.

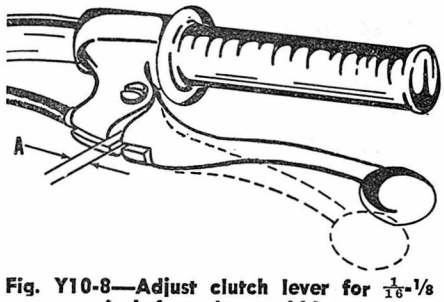


Fig. Y10-8—Adjust clutch lever for $\frac{1}{16}$-$\frac{1}{8}$ inch free play at (A).

LUBRICATION. The gearbox should be drained and refilled every 1200 miles with 0.75 qt. of SAE 10W/30 motor oil. Oil level in transmission should be maintained between two marks on dipstick with dipstick screwed in. Motorcycle should be held in a vertical position to check oil level.

Engine lubrication is accomplished with an automatic oil metering system. Oil tank should not be allowed to run dry and only 2-stroke engine oil should be used. Oil pump must be bled if allowed to run dry. To bleed pump, remove bleeder screw (2—Fig. Y10-6) and turn starter plate (3) upward while holding throttle fully open. When air is no longer present in oil coming from hole, replace screw. Oil pump adjustment should be checked with throttle fully closed. Mark on pump adjustment pulley (1—Fig. Y10-5) and guide pin (2) should align with throttle closed. Adjust pump by turning cable adjusters.

CLUTCH CONTROLS. Clutch is adjusted by loosening lock nut (2—Fig. Y10-7) and turning screw in until it seats lightly, then back screw out ¼ turn and tighten lock nut. Clutch lever should have $\frac{1}{16}$-$\frac{1}{8}$ inch free play as shown in Fig. Y10-8.

SUSPENSION. Front suspension units use SAE 10W/30 motor oil. The HT-1 requires 140 cc of fluid; CT-1 and AT-1 units require 152cc of fluid in each fork tube. Forks may be disassembled by removing the outer tube nut (13—Fig. Y10-9) and holding bolt (23). HT-1 units are similar but have no bolt (23).

Rear suspension units are not repairable and should be renewed if leaking or damaged.

REPAIRS

CYLINDER, PISTON AND RINGS. It is necessary to remove the head, exhaust pipe, oil delivery line, and cylinder to remove the piston. Use the following repair specifications:

Ring end gap .....0.006-0.014 inch
Piston skirt to cylinder
clearance .....0.0016-0.0018 inch

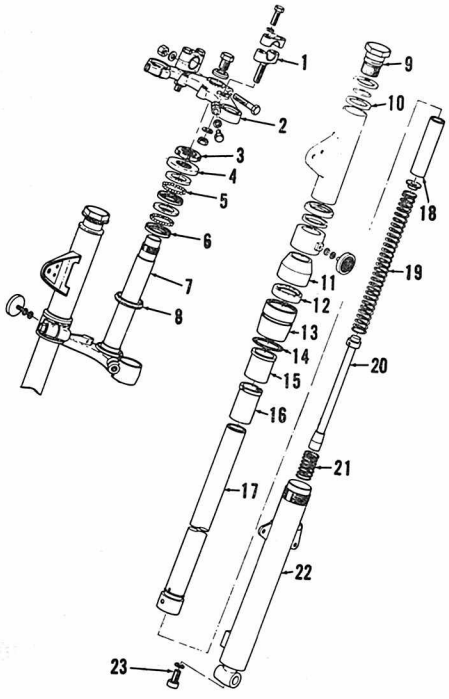


Fig. Y10-9—Exploded view of typical CT-1 and AT-1 front end assembly. HT-1 units are similar.

1. Handle bar holder assembly
2. Handle crown
3. Fitting nut
4. Ball race cover
5. Ball bearings
6. Bearing race
7. Steering stem
8. Dust seal
9. Cap bolt
10. Cover upper guide
11. Dust seal
12. Oil seal
13. Outer tube nut
14. "O" ring
15. Metal slider
16. Spacer
17. Fork inner tube
18. Spacer
19. Fork spring
20. Damper valve
21. Fork sub spring
22. Fork outer tube
23. Holding bolt

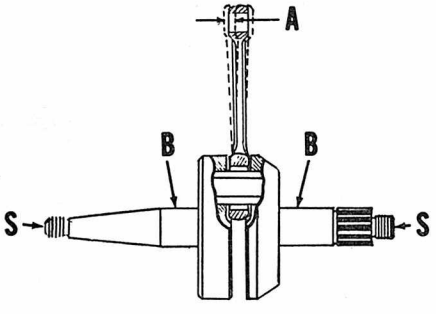


Fig. Y10-10—Support crankshaft on lathe centers at points (S) and place dial indicators at (B) to check runout.

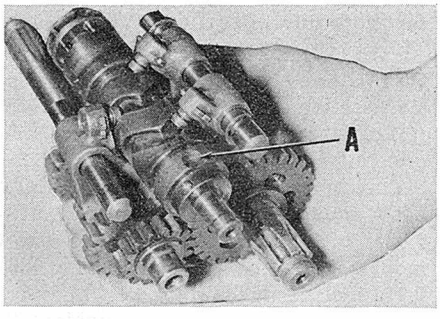


Fig. Y10-11—Transmission and shifter assembly ready for installation. Note position of shift stopper ball detent (A).

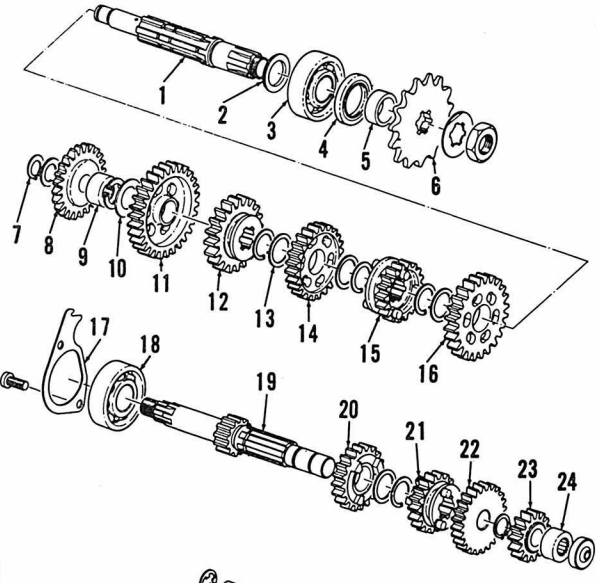


Fig. Y10-12 — Exploded view of typical transmission unit.

1. Drive axle
2. Spacer
3. Ball bearing
4. Oil seal
5. Distance collar
6. Drive sprocket
7. Snap ring
8. Kick idle gear
9. Needle bearing
10. Shim
11. First gear
12. Fourth gear
13. Washer
14. Third gear
15. Fifth gear
16. Second gear
17. Cover plate
18. Ball bearing
19. Main axle
20. Fourth pinion gear
21. Third pinion gear
22. Fifth pinion gear
23. Second pinion gear
24. Needle bearing

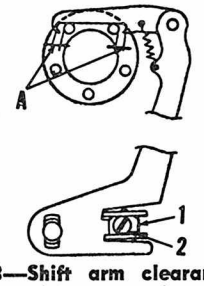


Fig. Y10-13—Shift arm clearance is adjusted by turning eccentric screw (2). Clearance (A) should be equal.

Maximum cylinder out of round or taper .....0.0019 inch

Arrow on piston should be toward front of engine (exhaust side). Marks on rings indicate top side. Rings with "2" stamped on them belong in second groove from top of piston. Piston should be measured ⅜ inch from bottom at right angles to pin hole for cylinder clearance check. Piston pin should have a snug fit. Torque head retaining hardware to 15-18 foot pounds using a cross pattern to prevent head warpage.

CRANKCASE AND CRANKSHAFT. The crankcase may be split after removing cylinder and screws in left side case. Clean mating surfaces well and use a non-hardening type sealer when assembling the crankcase halves.

Crankshaft runout should be no more than 0.0012 inch. Small end shake (A—Fig. Y10-10) should be no more than 0.078 inch. Side clearance between large end of rod and crank cheek should be 0.015-0.019 inch.

TRANSMISSION. The transmission is a five speed, constant mesh unit. The transmission and shifter assembly must be installed as a unit and in the neutral position in left engine case. Parts cannot be installed separately. Refer to Fig. Y10-11.

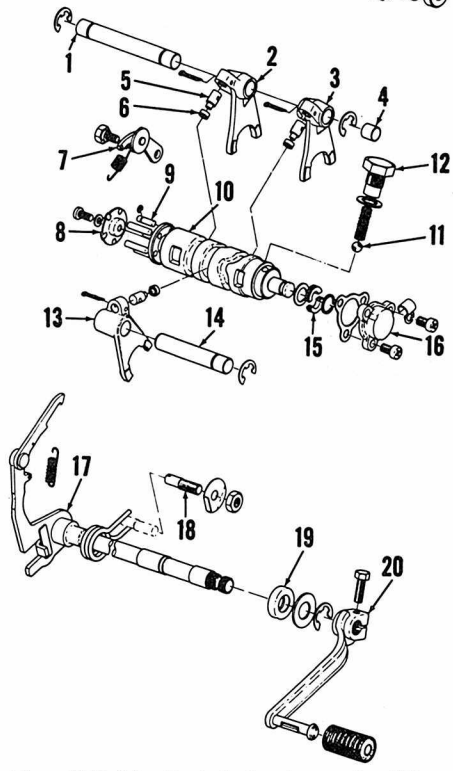


Fig. Y10-14—Exploded view of shifter assembly.

1. Shift fork guide bar
2. Third shift fork
3. First shift fork
4. Blind plug
5. Cam follower pin
6. Cam follower roller
7. Stopper lever assembly
8. Slide plate
9. Locating pin
10. Shift cam
11. Steel ball
12. Neutral spring screw
13. Second shift fork
14. Shift fork guide bar
15. Shift cam holders
16. Blind shift cam plug
17. Change shaft assembly
18. Eccentric screw
19. Oil seal
20. Shift lever

Gear shift arm to pin clearance (A—Fig. Y10-13) should be equal. Clearance is adjusted by loosening lock nut (1) and turning eccentric screw (2).

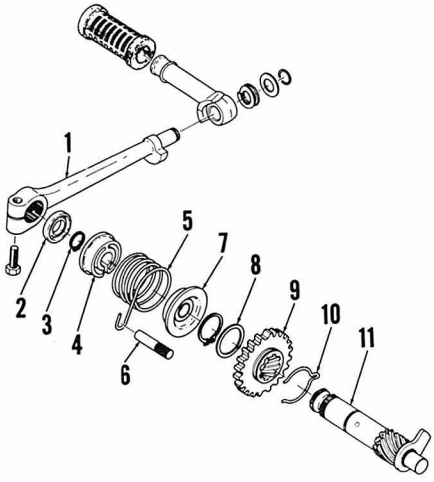


Fig. Y10-15—Exploded view of typical kick starter.

1. Kick crank
2. Oil seal
3. Retaining clip
4. Spring cover
5. Kick spring
6. Spring guide
7. Spring stopper
8. Retaining clip
9. Shim (two piece gear holder on some models)
10. Kick gear
11. Kick axle assembly

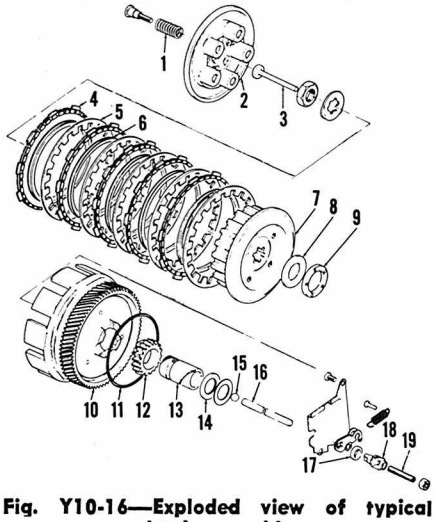


Fig. Y10-16—Exploded view of typical clutch assembly.

1. Clutch spring
2. Pressure plate
3. Push rod
4. Friction plate
5. Steel plate
6. Rubber cushion
7. Clutch boss
8. Shim
9. Bearing
10. Primary driven gear
11. "O" ring
12. Kick pinion gear
13. Distance collar
14. Thrust plate
15. Ball
16. Push rod
17. Oil seal
18. Push screw
19. Adjusting screw

CLUTCH. Clutch is of the wet, multi-disc type. It has five molded cork friction plates and five steel plates. Standard free length of HT-1 clutch springs is 1.34 inch (34 MM). AT-1 and CT-1 spring free length is 1.24 inch (31.5 MM). Clutch springs should be renewed if free length is 0.04 inch less than standard. Standard thickness of a friction plate is 0.157 inch (4 MM). Plates should be renewed if overheating, distortion, or uneven wear is evident.

SPEED TUNING

The 125cc AT-1 and 90cc HT-1 are offered in a competition version (MX models). These models are basically standard with parts

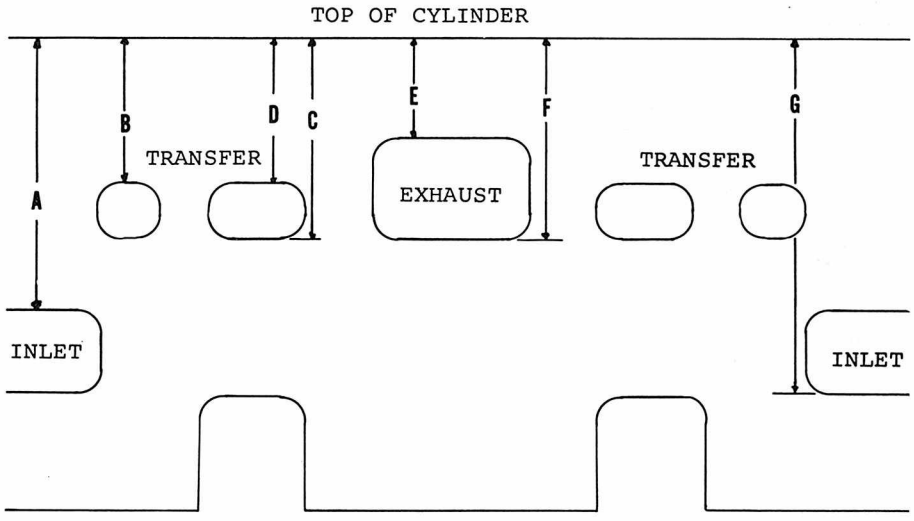


Fig. YT10-1—Cylinder porting diagram for Yamaha 90, 125 and 175 cc single Enduro models. Refer to text for modification specifications.

nonessential for competition removed and specialized "GYT" parts installed such as high compression head, modified piston, larger carburetor, expansion chamber and specially ported cylinder. Many standard parts may be modified to meet "GYT" specifications. The following paragraphs list some of the differences between MX models and standard models. Due to the similarities in the CT-1 and AT-1 models, many of the modifications will work on both versions. These specifications are a guide only and will void warranty on any machine they are applied to.

SPARK PLUG. An NGK type B-9E is recommended for use in competition models. Plug readings should be carefully checked to insure that proper heat range is used.

CARBURETOR. Standard HT1-MX carburetor is a Mikuni VM 24 SH sliding valve unit. AT1-MX models are equipped with VM 26 SH carburetors. A "GYT" carburetor for the 250cc DT1-MX has been found to work well on modified 175cc CT-1 units.

The following specifications are standard. Final selection of proper sizes will depend on track conditions.

HT1-MX	**VM 24 SH**
Main jet	#130
Jet needle	4DH7
Needle jet	N-8
Throttle slide	2.0

Jet needle clip in second groove from top of needle.

AT1-MX	**VM 26 SH**
Main jet	190
Jet needle	4 F 15
Needle jet	0-2
Throttle slide	1.5

Jet needle clip in second groove from top of needle.

CT-1 (DT1-MX)	**VM 30 SH**
Main jet	200
Jet needle	5 DP 7
Needle jet	0-2
Throttle slide	3.5

Jet needle clip in third groove from top of needle.

IGNITION. Ignition should occur on, AT1-MX and modified CT-1 models, when piston is 2.0 MM (0.078 inch) BTDC instead of the standard 1.8 MM (0.070 inch) BTDC. Ignition should occur on HT1-MX when piston is 2.5 MM (0.098 inch) BTDC.

An AT1-MX magneto may be fitted to standard models. If magneto is used (standard on HT1 and CT1) remove unused wiring and connect black lead from magneto to high tension ignition coil primary lead.

LUBRICATION. Oil metering system may be left in place but a 30:1 fuel to oil mix should be used in the fuel tank. If the oil metering system is removed, a 15:1 fuel to oil mix should be used. Oil used in storage tank should be same type used in fuel mix. Only oils recommended for use in air cooled two stroke engines should be used.

SUSPENSION. Weight and amount of oil in front suspension units may be varied to obtain feel desired. Suspension units (both front and rear) from the 250cc DT-1 may be bolted in place on AT-1 and CT-1 models for more durability.

PISTON, CYLINDER AND HEAD. Pistons used in the MX (GYT) versions of the AT-1 and HT-1 are 3 MM (0.118 in.) shorter than standard and use only the top piston ring. CT-1 pistons may also be shortened 3 MM. Ring end gap should be set at 0.016-0.024 inch for AT1-MX and CT-1 models. Ring end gap should be 0.006-0.014 inch for HT1-MX.

Both CT-1 and AT-1 models will perform well with cylinders modified to AT1-MX specifications.

AT1-MX (GYT-Kit) Cylinder Specifications (Fig. YT10-1)
A. Same as standard
B. Same as standard
C. Same as standard
D. 39 MM (1.535 in.)
E. 27 MM (1.063 in.)
F. Same as standard
G. 87 MM (3.425 in.)

The exhaust port on HT-1 "GYT" (MX) cylinder is raised 3 MM (0.118 in.) at top and bottom (E&F-YT-10-1). Transfer ports are 1 MM higher (B,D&C) while intake port is lowered 3 MM on top (A) and 1.5 MM on the bottom (G).

Cylinder heads may be milled to match the capacity of the MX units. Standard head capacity of an AT-1 is 14.6 cc. AT1-MX head capacity is 11.9 cc. A CT-1 head may be safely modified to a capacity of 19.2 cc instead of the standard 24.2 cc. An HT1-MX has a head capacity of 8.3 cc. Taper at edge of combustion chamber must be reshaped after milling head. (See Fig. YT 10-2).

EXPANSION CHAMBER. The expansion chamber designed for the AT1-MX will also work well on CT-1 models.

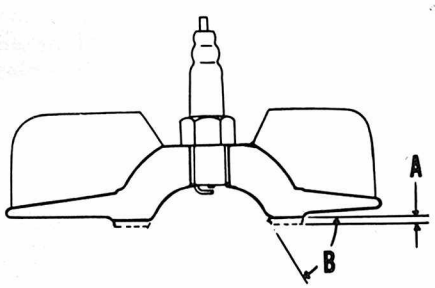


Fig. YT10-2—Angle of taper (B) must be remachined in head after it has been modified for higher compression.

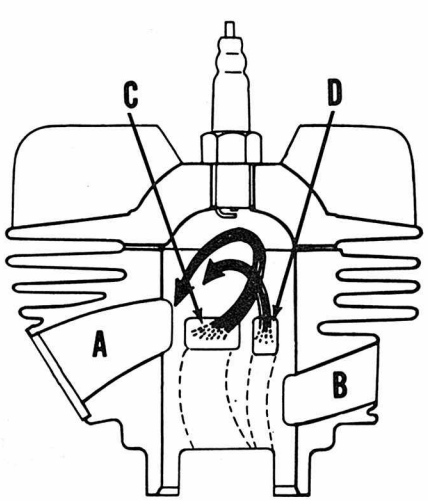


Fig. YT10-3—Basic port pattern of cylinder may be seen in this drawing.

A. Exhaust port
B. Intake port
C. Main transfer port
D. Auxiliary transfer port

An HT1-MX expansion chamber may be constructed from the following specifications. (Refer to Fig. YT 10-4)
A. 35 MM (1.378 in.)
B. 220 MM (8.661 in.)
C + D. 300MM (11.811 in.)
E. 110 MM (4.33 in.)
F. 200 MM (7.874 in.)
G. 200 MM (7.874 in.)
H. 21 MM (0.827 in.)
I. 100 MM (3.937 in.)
J. Sections C&D are same cone
K. 40 MM (1.574 in.)

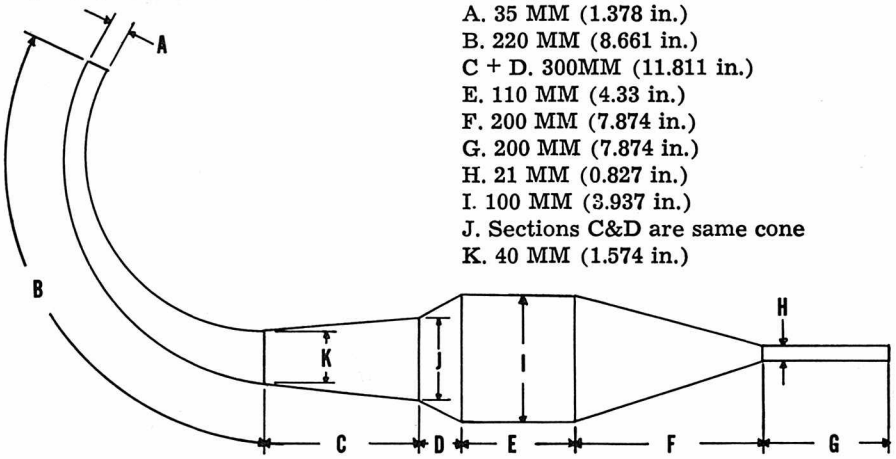


Fig. YT10-4—An expansion chamber will improve the performance of a correctly modified engine. Refer to text for specifications of an HT1-MX expansion chamber.

YAMAHA 350 CC TWIN MODEL R5

MODEL	R5, R5 B
Displacement-cc	347
Bore-MM	64
Stroke-MM	54
Number of cylinders	2
Oil-Fuel ratio	Oil injection
Plug gap-inch	0.024-0.028
Point gap-inch	0.012-0.016
Ignition timing	Fixed
Piston position BTDC-inch	0.078
Electrical system voltage	12
Battery terminal grounded	Negative
Tire size-Front	3.00x18
Rear	3.50x18
Tire pressure-Front	22 PSI
Rear	28 PSI
Rear chain free play-inch	¾
Number of speeds	5
Weight-lbs. (approx.)	308

MAINTENANCE

SPARK PLUG. Recommended spark plug is the NGK type B-9HC with an electrode gap of 0.024-0.028 inch. A Champion L 57 R is a suitable replacement.

CARBURETOR. Two Mikuni VM 28 SC carburetors are used on R5 models. Idle air screw (6—Fig. Y11-1) should by 1¾ turns out from a lightly seated position. Ajust idle speed to 1300-1400 RPM by turning the idle stop screw (8). Float level (A—Fig. Y11-2) is adjusted by bending tang (B) and should be set at 1 inch. Refer to Fig. Y11-1 and the following specifications:

Main jet (4) ..... #110
Needle jet (3) 0-0
Jet needle (2) .....5 DP 7
Pilot jet (5) ..... #40

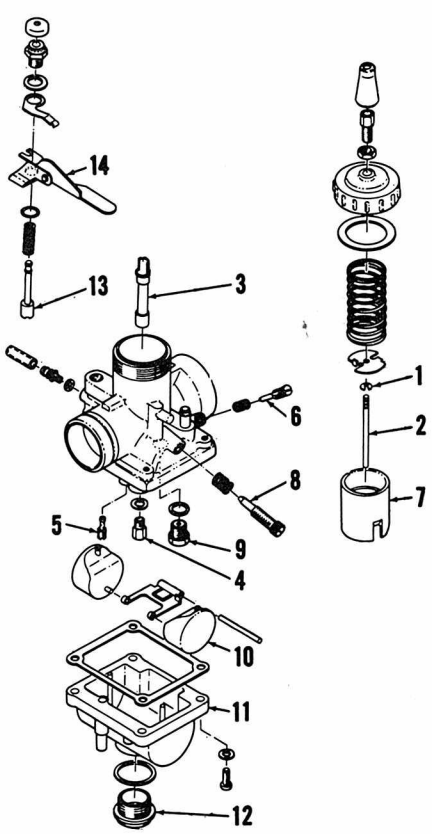


Fig. Y11-1—Exploded view of carburetor used on R5 models.

1. Jet needle clip
2. Jet needle
3. Needle jet
4. Main jet
5. Pilot jet
6. Pilot air screw
7. Throttle slide
8. Throttle stop screw
9. Valve seat assembly
10. Float
11. Float bowl
12. Float bowl drain plug
13. Starter plunger
14. Starter lever

Clip (1) in fourth groove from top of needle (2).

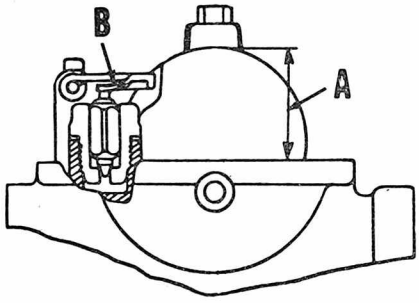


Fig. Y11-2—Float level (A) should be measured from gasket surface with gasket removed. Adjust level by bending tang (B).

IGNITION AND ELECTRICAL. A 12 volt battery is located under the seat. The alternator is mounted at left end of crankshaft. A rectifier (also mounted beneath seat) is used to convert AC current to DC current for battery charging, lights and other electrical functions.

Maximum point gap should be 0.012-0.016 inch and can be adjusted after loosening screws (1—Fig. Y11-3). Ignition should occur (points just open) when piston is 0.078 inch. BTDC. Timing marks (3 & 4) should align at this point. Ignition timing should be checked separately for each cylinder. Loosening screws (2) will allow movement of breaker base plate and adjustment of timing for one cylinder. Orange wire is for left cylinder.

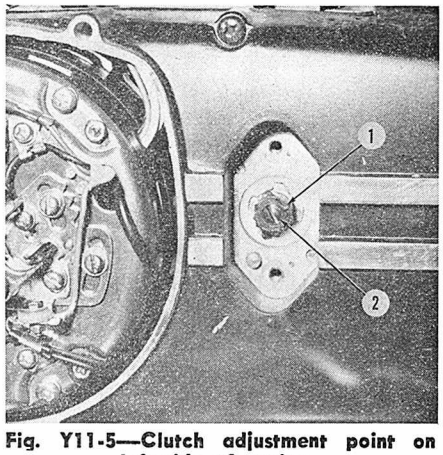


Fig. Y11-5—Clutch adjustment point on left side of engine.

LUBRICATION. The gearbox contains 1.6 qt. of SAE 10W/30 motor oil. Lubricant should be drained and renewed every 1200 miles.

Engine lubrication is accomplished by an automatic oil metering system. Only oils intended for use in air cooled two cycle engines should be used. Adjust pump control cable so that mark on pulley (1—Fig. Y11-4) is lined up with pin (2) when engine is at idle (1300-1400 RPM).

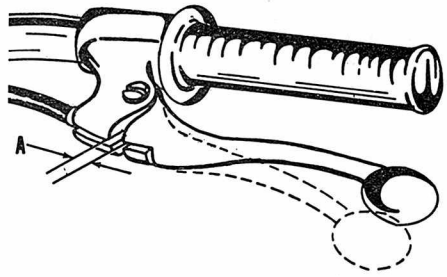


Fig. Y11-6—Adjust clutch cable to obtain $\frac{1}{16}$-⅛ inch free play at (A).

Should pump be allowed to run dry or if it has been removed it will be necessary to bleed the system. Remove bleeder bolt (3—Fig. Y11-4) and turn starter plate (4) in direction of arrow until pure oil (no air bubbles) is coming from bleeder hole. Holding throttle wide open will speed bleeding operation. Replace bleeder bolt and check for leaks with engine running.

CLUTCH CONTROLS. To adjust clutch, remove the small cover on left side of engine case. Loosen lock nut (1—Fig. Y11-5) and turn screw (2) in until it seats lightly. Back screw out ¼ turn and tighten lock nut. The clutch lever should be adjusted to provide $\frac{1}{16}$-⅛ inch free play. Refer to Fig. Y11-6.

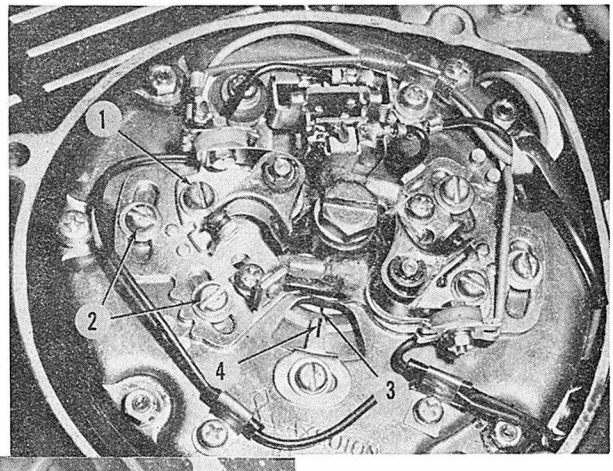


Fig. Y11-3—Engine should be timed with a dial gage to make certain that pointer (4) is in correct position before relying completely on pointer for timing.

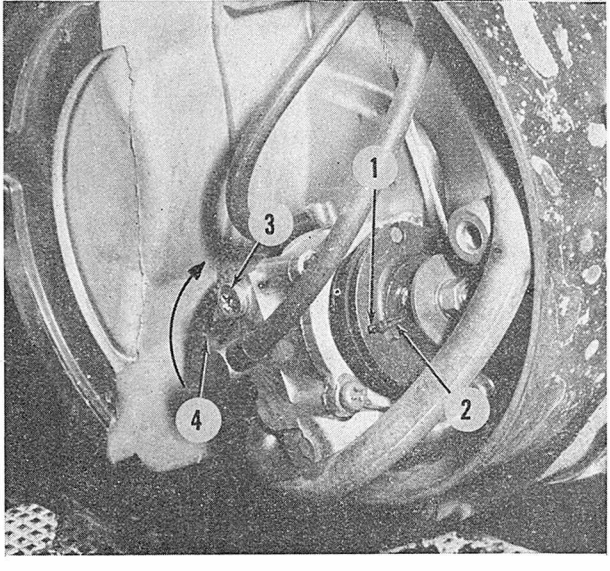
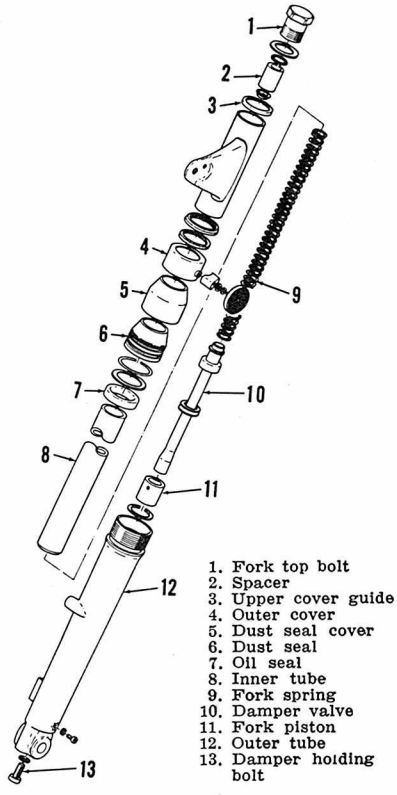


Fig. Y11-4—Adjust pump cable so that marks align as slack is just taken up in throttle cable.



1. Fork top bolt
2. Spacer
3. Upper cover guide
4. Outer cover
5. Dust seal cover
6. Dust seal
7. Oil seal
8. Inner tube
9. Fork spring
10. Damper valve
11. Fork piston
12. Outer tube
13. Damper holding bolt

Fig. Y11-7—Exploded view of typical front suspension unit.

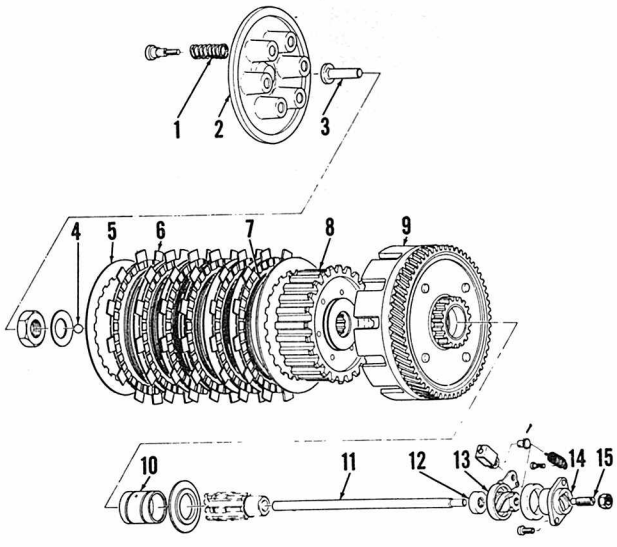


Fig. Y11-8 — Exploded view of typical clutch assembly.

1. Clutch spring
2. Pressure plate
3. Push rod
4. Ball
5. Steel clutch plate
6. Cork friction plate
7. Cushion ring
8. Clutch boss
9. Primary driven gear assembly
10. Spacer
11. Push rod
12. Push rod seal
13. Push lever assembly
14. Push screw housing
15. Clutch adjusting screw

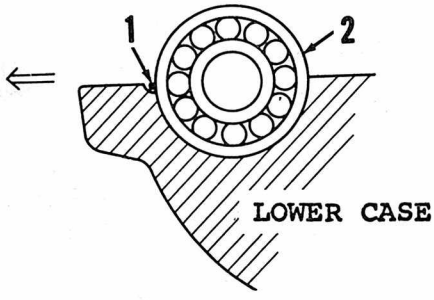


Fig. Y11-9—Crankshaft ball bearings have guide pins (1) that should be placed in recess in the lower crankcase half.

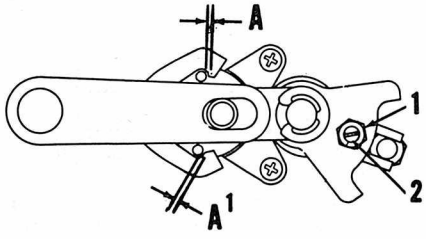


Fig. Y11-10—Turn eccentric screw (2) until clearance (A) is equal.

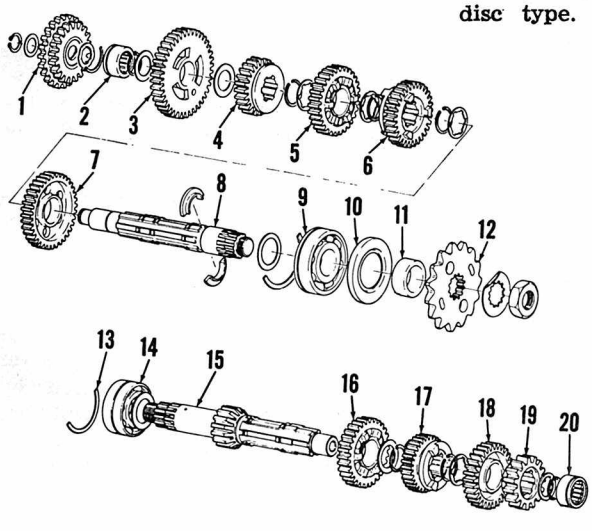


Fig. Y11-11 — Exploded view of R5 transmission. Gears (5 & 16) are identical.

1. Idle gear assembly
2. Bearing
3. First gear wheel
4. Fifth gear wheel
5. Third gear wheel
6. Fourth gear wheel
7. Second gear wheel
8. Drive axle
9. Ball bearing
10. Oil seal
11. Distance collar
12. Chain sprocket
13. Bearing retaining clip
14. Ball bearing
15. Main axle
16. Fifth pinion gear
17. Third pinion gear
18. Fourth pinion gear
19. Second pinion gear
20. Needle bearing

SUSPENSION. Each front suspension unit contains 145cc of SAE 10W/30 motor oil. Front forks may be disassembled by removing bolt (13—Fig. Y11-7). Rear suspension units cannot be repaired and should be renewed if leaking or damaged.

REPAIRS

PISTON AND CYLINDER. Pistons may be removed after removal of heads, exhaust pipes, carburetors, oil lines and cylinders. Use the following repair specifications:

Ring end gap.....0.018-0.026 inch
Piston skirt to cylinder
clearance .....0.0016-0.0018 inch
Cylinder taper or out
of round .....0.002 inch

Measure piston skirt ⅜ inch from bottom of skirt at right angle to piston pin hole for cylinder clearance. Install rings with markings to the top. Install pistons with arrow toward front of engine (exhaust side). Torque cylinder head retaining nuts to 15 foot pounds using a cross pattern to prevent head warpage.

CLUTCH. The clutch is wet multi-disc type. It has six molded cork friction plates and seven steel plates. Standard free length of a clutch spring is 1.41 inch (36 MM). Springs should be renewed if 0.04 inch (1 MM) shorter than standard. Standard thickness of a friction plate is 0.118 inch (3 MM). Renew plates if wear is uneven or plates are less than 90% of original thickness.

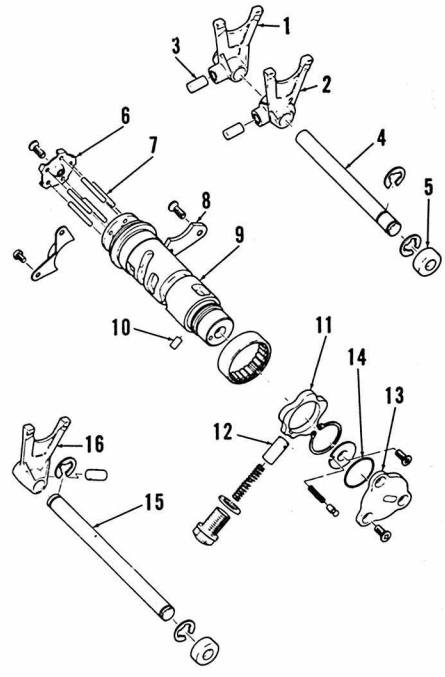


Fig. Y11-12 — Exploded view of shifter assembly.

1. First shift fork
2. Second shift fork
3. Cam follower pin
4. Second shift fork guide bar
5. Blind plug
6. Side plate
7. Dowel pins
8. Stopper plate
9. Shifting cam
10. Dowel pin
11. Stopper plate
12. Stopper cam
13. Neutral switch assembly
14. "O" ring
15. First shift fork guide bar
16. Second shift fork (interchangable with 2)

CRANKCASE AND CRANKSHAFT. Crankcase screw holes are numbered on the lower case. To disassemble engine, remove bolts in reverse order, beginning with highest number. Reassemble starting with lowest number.

Small end of connecting rod should move sideways (shake) no more than 0.078 inch (2 MM). Crankshaft runout should be no more than 0.0012 inch and side clearance between connect-

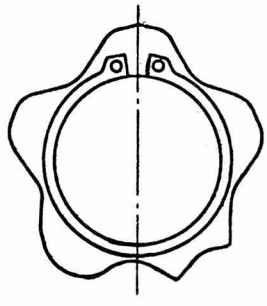


Fig. Y11-13—Position open end of snap ring on stopper plate (11—Fig. Y11-12) as shown.

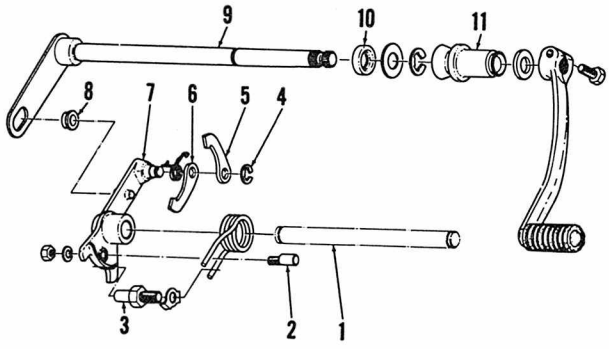


Fig. Y11-14 — Exploded view of shifting linkage used on model R5.

1. First shift fork guide bar
2. Eccentric screw
3. Stopper screw
4. Snap ring
5. Change lever
6. Change lever
7. Bracket
8. Change lever roller
9. Change shaft assembly
10. Oil seal
11. Sealing boot

ing rod and crank cheek should be 0.004-0.010 inch. Align pin on the main bearings with the recess in lower case half when reassembling. See Fig. Y11-9.

Inspect gears for wear, burning and broken teeth. Inspect shift forks for burning and wear.

Gear change lever arm should be adjusted so that clearance (A—Fig. Y11-10) is equal at both points. Loosen lock nut (1) and turn eccentric screw (2) until clearance is correct.

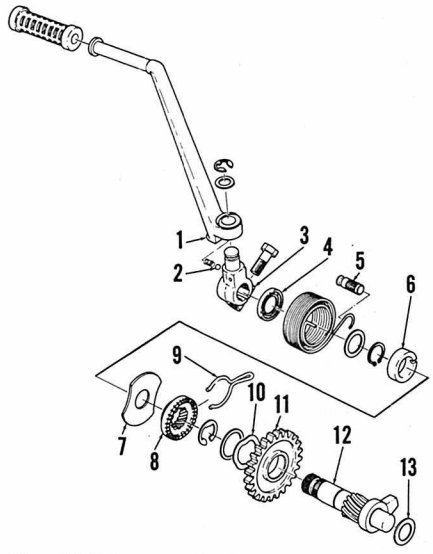


Fig. Y11-15 — Exploded view of kick starter assembly.

1. Kick lever
2. Steel ball
3. Kick lever boss
4. Oil seal
5. Kick spring stopper
6. Spacer
7. Spring cover
8. Ratchet wheel
9. Clip
10. Wave washer
11. Kick gear
12. Kick axle assembly
13. Washer

YAMAHA MINI ENDURO

MODEL	JT-1
Displacement-cc	58
Bore-MM	42
Stroke-MM	42
Number of cylinders	1
Oil-Fuel ratio	Oil Injection
Plug gap-inch	0.020-0.024
Point gap-inch	0.012-0.015
Ignition timing	Fixed
Piston position BTDC-inch	0.070
Tire size-Front	2.50x15
Rear	2.50x15
Tire pressure-Front	22
Rear	28
Rear chain free play-inch	1
Number of speeds	4
Weight-Lbs. (approx.)	121

MAINTENANCE

SPARK PLUG. Recommended spark plug is an NGK type B-7HS with an electrode gap of 0.020-0.024 inch. A Champion type L-81 may also be used.

CARBURETOR. A Mikuni Y 16 P sliding valve carburetor is used. Idle air screw (7—Fig. Y12-1) should be 1½ turns out from a lightly seated position. Float level is non adjustable. Refer to Fig. Y12-1 and the following standard specifications:

Main jet (3)	86
Needle jet (2)	2.085
Jet needle (9)	32
Pilot jet (1)	38
Starter jet (4)	50

Clip (10) in second groove from top of needle (9).

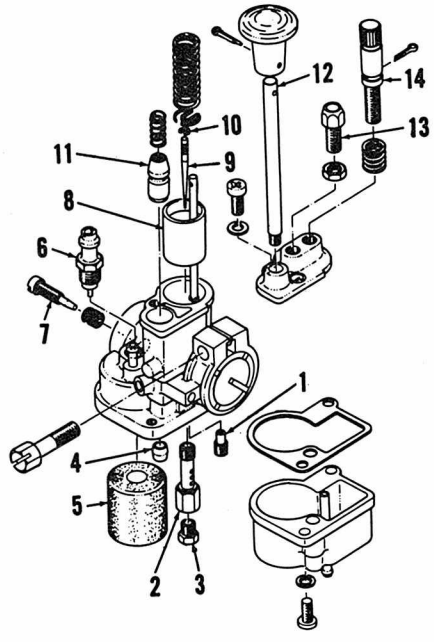


Fig. Y12-1 — Exploded view of sliding valve carburetor used on the JT-1.

1. Pilot jet
2. Needle jet
3. Main jet
4. Starter jet
5. Float
6. Valve seat assembly
7. Pilot air screw
8. Throttle valve
9. Jet needle
10. Jet needle clip
11. Starter assembly plunger
12. Starter rod
13. Throttle wire adjusting screw
14. Idle adjusting screw

IGNITION AND ELECTRICAL. An energy transfer magneto is used. The low tension ignition coil is located under flywheel and high tension ignition coil is frame mounted under fuel tank.

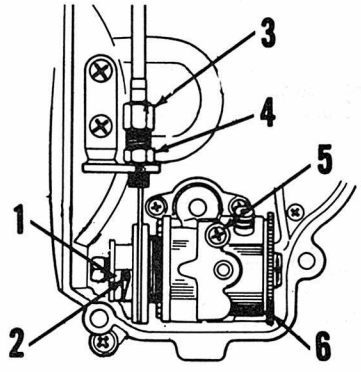


Fig. Y12-2—Throttle should be held open during bleeding to speed the operation.

Maximum point gap should be set at 0.012-0.015 inch. Ignition should occur (points just open) when piston is 0.07 inch BTDC. If breaker point gap is correctly set, timing should be correct.

A kill switch, mounted on the handlebar, is used to ground low tension coil.

LUBRICATION. The transmission is lubricated with 0.64 qt. of SAE 10W/30 motor oil.

Engine lubrication is accomplished with an automatic oil metering system. Oil stored in a separate tank is pumped to the rotary valve cover with quantity being controlled by amount of throttle opening. Only oil intended for use in air cooled two stroke engine should be used in the system.

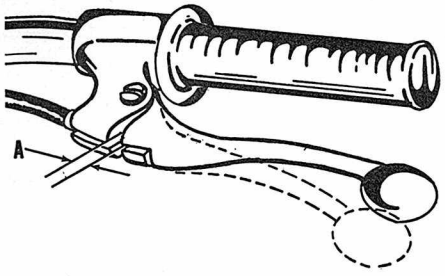


Fig. Y12-3 — Clutch lever should have $\frac{1}{16}$-⅛ inch free play at (A).

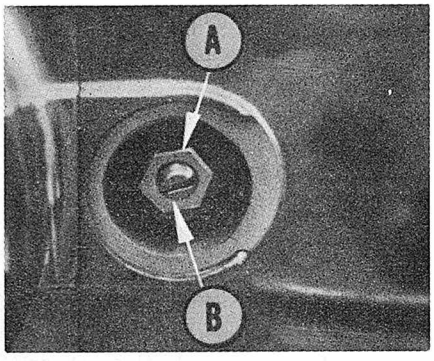


Fig. Y12-4—Remove cap on left side of engine to make clutch adjustment.

Oil pump adjustment is checked by removing carburetor cover and observing that arrow on the pump adjustment pulley (1—Fig. Y12-2) is aligned with guide pin (2) when throttle is in idle position. Pump control cable guides may be adjusted to correct if alignment is off.

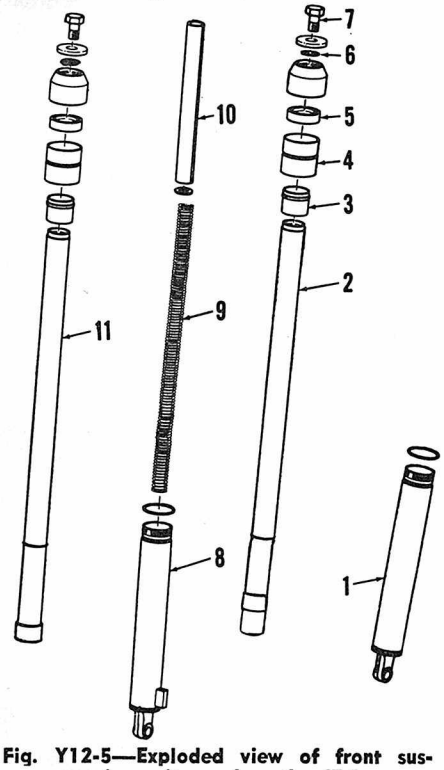


Fig. Y12-5—Exploded view of front suspension units used on the JT-1.

1. Left outer tube
2. Left inner tube
3. Metal slider
4. Outer tube nut
5. Oil seal
6. "O" ring
7. Fork top bolt
8. Right outer tube
9. Fork spring
10. Fork spacer
11. Right inner tube

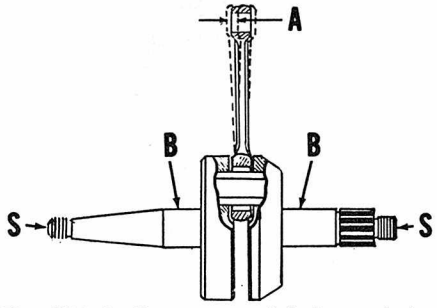


Fig. Y12-6—Support crankshaft on lathe centers at point (S) and use dial indicators at point (B) to measure crankshaft runout.

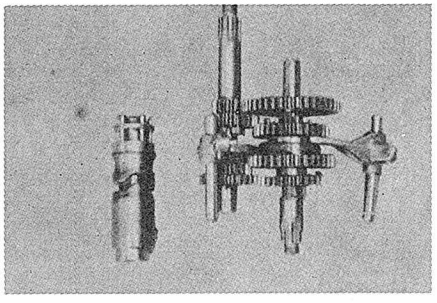


Fig. Y12-7—Transmission and shifter assembly should be installed in left engine case as a unit.

If pump is allowed to run dry or if it has been removed it will be necessary to bleed the system. Remove bleeder bolt (5) and turn starter plate (6) in direction of arrow stamped on plate. Hold throttle full on and turn starter plate until air no longer exists in oil coming from bleeder hole.

Throttle cable should have approximately 0.04 inch free play with slide at idle position.

CLUTCH CONTROLS. Clutch may be adjusted after removing rubber cap on left side engine case. Loosen lock nut (A—Fig. Y12-4) and turn screw (B) out until loose. Turn screw (B) back in until it lightly seats and then back it out ¼ turn and tighten lock nut (A). Clutch cable should be adjusted to obtain $\frac{1}{16}$-⅛ inch free play in lever as shown in Fig. Y12-3.

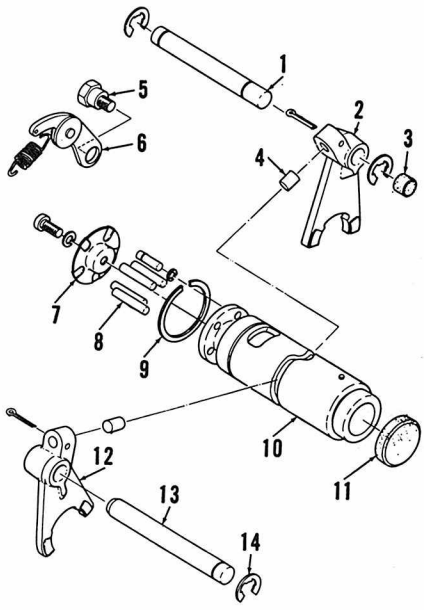


Fig. Y12-9—Exploded view of shift cam assembly.

1. Shift fork guide bar
2. Shift fork
3. Blind plug
4. Cam follower pin
5. Stopper bolt
6. Stopper lever
7. Side plate
8. Locating pin
9. Snap ring
10. Shifting cam
11. Blind plug
12. Shift fork
13. Shift fork guide bar
14. Snap ring

SUSPENSION. Front suspension units are not identical. Right unit has an internal spring (9—Fig. Y12-5), spacer (10) and contains 97cc of oil. Unit on left side has no spring and contains 120cc of oil. Oil used should be SAE 10W/30 motor oil.

Rear suspension units are not repairable and should be renewed if leaking or damaged.

REPAIRS

PISTON AND CYLINDER. Cylinder and piston may be removed with-

1. Idle kick gear
2. Wave washer
3. Thrust washer (O.D.-23 MM)
3A. Thrust washer (O.D.-22 MM)
4. Shim (O.D.-24 MM)
5. First gear
6. Third gear
7. Snap ring
8. Second gear
9. Spacer
10. Fourth gear
11. Drive axle
12. Ball bearing
13. Spacer
14. Oil seal
15. Drive sprocket
16. Bearing cover plate
17. Ball bearing
18. Main axle
19. Third pinion gear
20. Second pinion gear
21. Fourth pinion gear
22. Clutch push rod seal

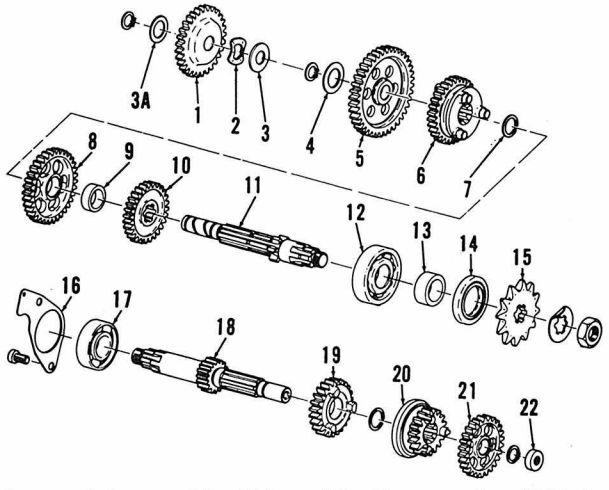


Fig. Y12-8—Exploded view of transmission used in JT-1 models. Thrust washer (3A) is available in three different thicknesses.

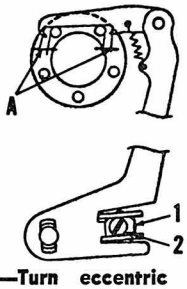


Fig. Y12-10—Turn eccentric screw (2) until shift arm to pin clearance (A) is equal.

out removing engine from frame. Refer to the following repair specifications:

Maximum cylinder taper or out of round .....0.002 inch
Ring end gap .....0.006-0.014 inch
Piston skirt to cylinder clearance ..... 0.0016-0.0018 inch

Piston should be installed with arrow on dome toward front (exhaust side) of engine. Markings on piston rings should be toward top. Piston pin should be snug fit in piston but not binding. Measure piston ⅜ inch from bottom at a right angle to pin hole for cylinder clearance check. Torque head retaining nuts to 7.5 Ft.-Lbs. (90 inch pounds) using a cross pattern to prevent warpage.

CRANKCASE AND CRANKSHAFT. Engine must be removed from frame and case halves must be separated to remove crankshaft assembly. Transmission and crankshaft should remain in left case half on disassembly. Maximum crankshaft runout is 0.0012 inch. Small end rod shake (A—Fig. Y12-6) should be no more than 0.078 inch.

Renew any burned or broken gears in transmission. Transmission and shifter assembly must be installed as a unit and can not be installed separately.

Case halves should be well cleaned for reassembly and a non hardening type sealer used on mating surfaces.

Clearance (A—Fig. Y12-10) must be equal for proper shifting. Clearance may be adjusted by loosening lock nut (1) and turning eccentric screw (2) until proper clearance is obtained.

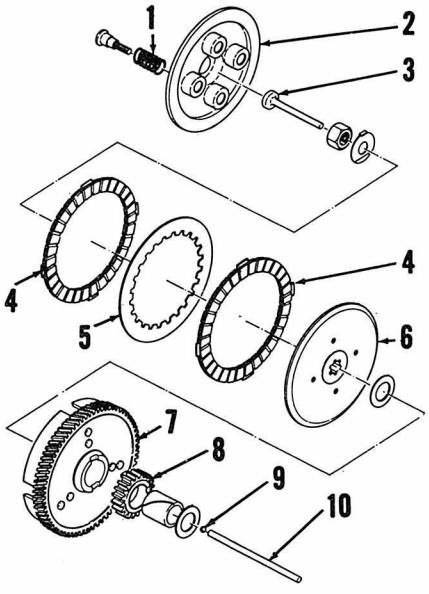


Fig. Y12-11 — Clutch assembly used on JT-1 models.

1. Clutch spring
2. Pressure plate
3. Push rod
4. Friction disc
5. Steel clutch disc
6. Clutch boss
7. Driven gear assembly
8. Kick pinion gear
9. Steel ball
10. Push rod

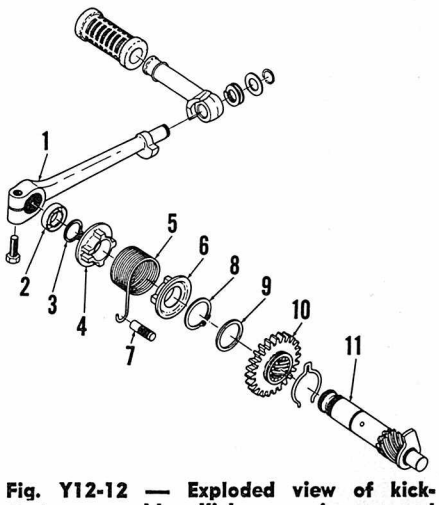


Fig. Y12-12 — Exploded view of kick-starter assembly. Kick gear is engaged with idle gear only when in use.

1. Kick crank
2. Oil seal
3. Snap ring
4. Spring cover
5. Kick spring
6. Stopper pin
7. Spring guide
8. Shim
9. Kick gear
10. Clip
11. Kick axle assembly

CLUTCH. A wet multi-disc unit with two friction discs and one steel plate is used. (Fig. Y12-11). Proper free length of clutch spring is 1.34 inch. Springs should be renewed if less than 1.30 inch. Standard thickness of a friction disc is 0.137 inch and discs should be renewed if worn to less than 0.123 inch thick.

YAMAHA G5 AND G6 MODELS

MODEL	G5-T*	G5-S* G6-S
Displacement-cc	73	73
Bore-MM	47	47
Stroke-MM	42	42
Number of cylinders	1	1
Oil-fuel ratio	Oil Injection	
Plug gap-inch	0.020-0.024	
Point gap-inch	0.012-0.014	
Ignition timing	Auto-Advance	Fixed
Piston position BTDC-inch	0.071	0.071
Electrical system voltage	12	6
Battery terminal grounded	Negative	
Tire size-front	2.50x17	2.50x17
Rear	3.00x17	2.50x17
Tire pressure-front	20 PSI	20 PSI
Rear	28 PSI	28 PSI
Rear chain free play-inch	⅞	1
Weight-lbs. (approx.)	185	170

*Earlier models are identified as YG5-T and YG5-S.

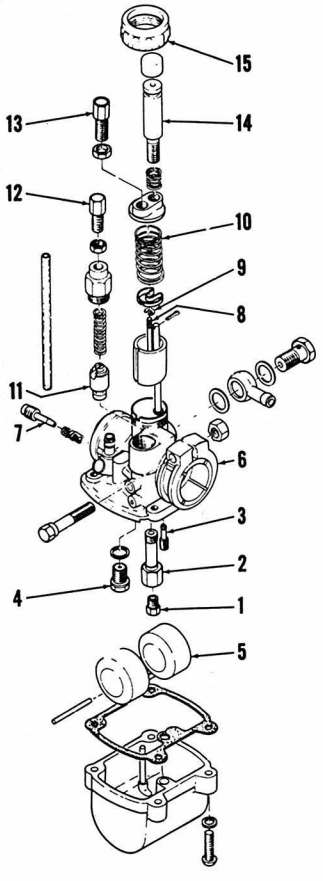


Fig. Y13-1—View of VM type carburetor used on G5 and G6 models.

1. Main jet
2. Needle jet
9. Pilot jet
4. Valve seat assembly
5. Floats
6. Mixing chamber body
7. Pilot air screw
8. Jet needle
9. Clip
10. Throttle return spring
11. Starter plunger
12. Starter cable adjuster
13. Throttle adjusting screw
14. Idle speed adjuster
15. Mixing chamber cap

MAINTENANCE

SPARK PLUG. The recommended spark plug for all models is NGK type B-7HZ with a 0.020-0.024 inch electrode gap.

CARBURETOR. A Mikuni VM16SC is used on all models. Air screw (7—Fig. Y13-1) should be 1¾ turns out from seated position on G5-S and G6-S street models and 1½ turns out on Trailmaster G5-T models. Float level (A—Fig. Y13-2) should be 0.80 inch (20.5 MM) and is adjusted by bending tang (B). Refer to Fig. Y13-1 and the following standard specifications.

Main jet (1).....#120
Needle jet (2)..... E-2
Jet needle (8) 3G9
Pilot jet (3)..... #25

Clip (9) should be in fourth groove from top of jet needle (8) on G5-T models; third groove on G5-S and G6-S models.

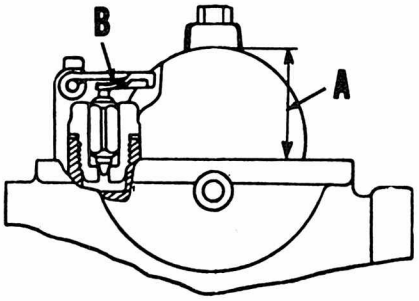


Fig. Y13-2—Float level (A) should be 0.8 inch and is adjusted by bending tang (B). Both floats should have equal height.

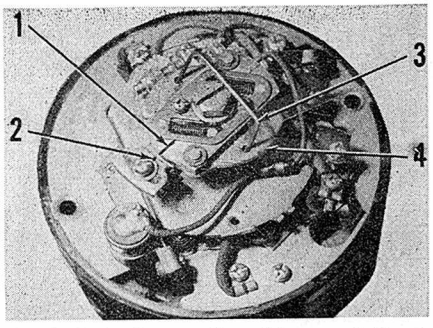


Fig. Y13-3—Secure flyweights to full advance position before adjusting ignition timing on electric start models.

1. Timing mark on governor
2. Timing mark on stator
3. Bent wire
4. Flyweight

IGNITION AND ELECTRICAL. Electric start models use a combination starter motor and generator with ignition contact breaker assembly on housing. Other models use a flywheel magneto with contact points mounted under the flywheel.

Set breaker point gap to 0.012-0.014 inch on all models. Ignition should occur (points just open) when piston is 0.071 inch (1.8 MM) BTDC on all models. On models with electric start, the governor flyweights must be held out when timing. See Fig. Y13-3. A bent spoke can be used to hold the flyweights in place for engine timing. A dial indicator should be used to locate piston at 0.071 inch BTDC. If point gap is set correctly on models with magneto ignition, timing should be right unless the crankshaft is bent or flywheel key is sheared.

LUBRICATION. The gear case should be drained and refilled with 0.65 qt. of SAE 10W/30 motor oil every 1200 miles.

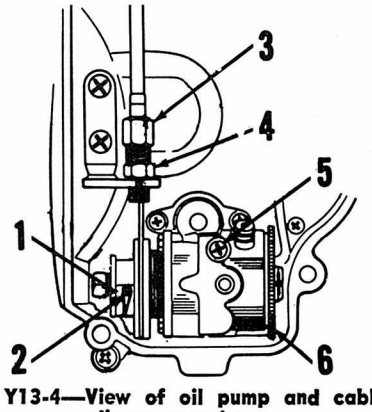


Fig. Y13-4—View of oil pump and cable adjustment points.

1. Adjusting plate
2. Guide pin
3. Cable adjusting screw
4. Lock nut
5. Bleeder bolt
6. Starter plate

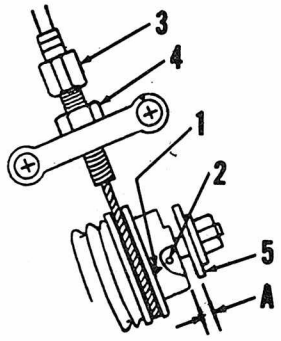


Fig. Y13-5—Clearance (A) between adjusting pulley and adjusting plate should be at least 0.006 inch.

1. Mark on pulley
2. Guide pin
3. Cable adjusting screw
4. Lock nut
5. Adjusting plate

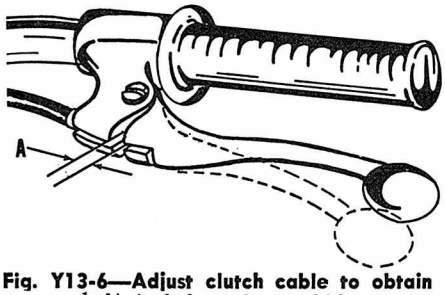


Fig. Y13-6—Adjust clutch cable to obtain $\frac{1}{16}$-$\frac{1}{8}$ inch free play at (A).

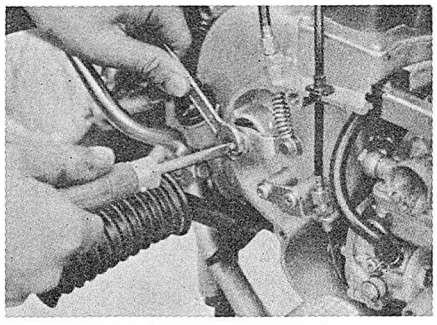


Fig. Y13-7—View of clutch adjustment on right side of engine.

The engine is lubricated by an automatic oil metering system. Amount of oil is controlled by engine speed and throttle opening. Minimum pump stroke is checked by inserting feeler gage between adjusting plate and adjusting pulley of oil pump. Turn starter plate (6—Fig. Y13-4) until gap is observed. Gap should be at least 0.006 inch. Adjust pump stroke by adding or removing shims under adjusting plate (5—Fig. Y13-5). Throttle should be fully closed during this check.

Throttle cable should have approximately $\frac{1}{16}$ inch free play when closed. Adjust the oil pump so that mark on the adjusting pulley (1—Fig. Y13-5) is lined up with the guide pin (2) when the "O" marked on throttle slide is just touching upper bore of carburetor. Pump is adjusted by turning adjusting screw (3) after loosening lock nut (4). If oil pump is removed or if it has been allowed to run dry, it will be necessary to bleed all air from the system. Remove bleeder bolt (5—Y13-4) and turn starter plate (6) until oil from bleeder hole is free of air. Replace bolt and run engine to check for oil leaks.

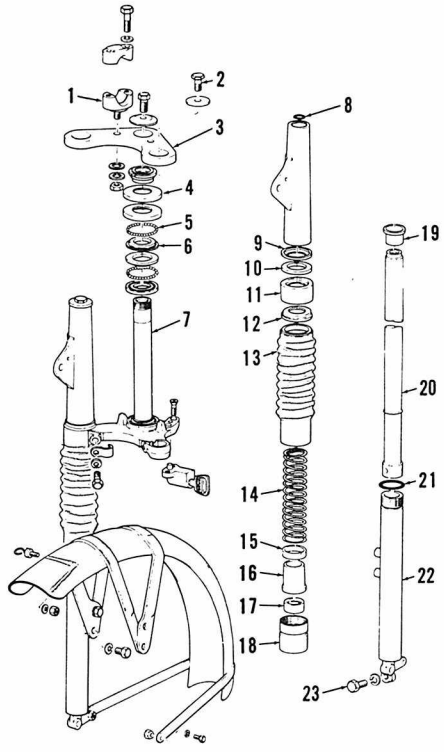


Fig. Y13-8—Exploded view of front suspension units typical of G5 and G6 models.

1. Handlebar clamp
2. Fork top bolt
3. Steering stem head
4. Bearing race cover
5. Ball bearings (19 each)
6. Bearing race
7. Steering stem
8. "O" ring
9. Fork cover guide
10. Packing
11. Outer cover
12. Upper spring seat
13. Boot
14. Fork spring
15. Spacer
16. Lower spring seat
17. Oil seal
18. Outer tube nut
19. Metal slide
20. Inner fork tube
21. "O" ring
22. Outer fork tube
23. Axle pinch bolt

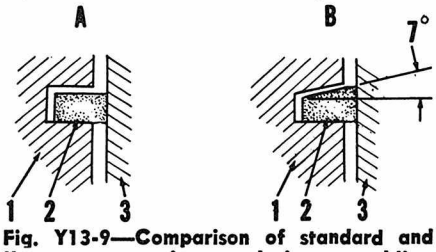


Fig. Y13-9—Comparison of standard and Keystone type piston and ring assemblies.

A. Standard piston and ring
B. Keystone piston and ring
1. Piston
2. Piston ring
3. Cylinder wall

CLUTCH CONTROLS. Clutch lever should be adjusted so there is $\frac{1}{16}$-$\frac{1}{8}$ inch free play as shown in Fig. Y13-6. To adjust clutch, remove the carburetor cover on right side of engine. Loosen lock nut and turn adjusting screw in until it lightly seats. Back the screw out ¼ turn and tighten the lock nut. See Fig. Y13-7.

SUSPENSION. Each front suspension unit on G5-T models contain 140cc of oil. On G5-S and G6-S models put 154cc in right unit and 136cc in left fork tube. SAE 10W/30 motor oil should be used in all models. Oil level in the front suspension units should be 13.2 inch (335 MM) below top of fork. Rear suspension units are not repairable and should be renewed if leaking or damaged.

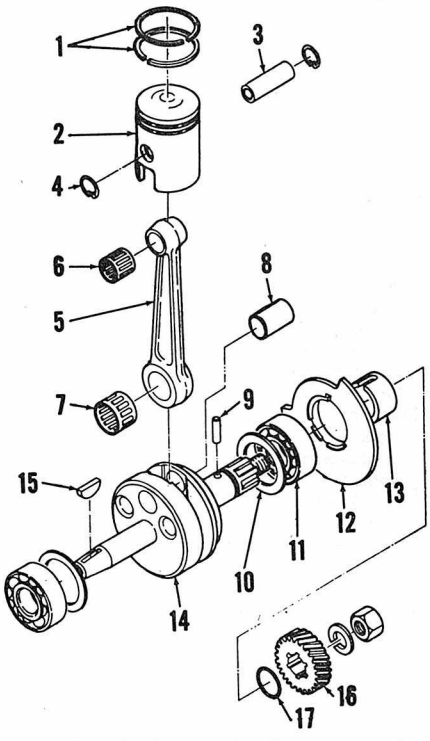


Fig. Y13-10—Exploded view of typical crankshaft assembly.

1. Piston rings
2. Piston
3. Piston pin
4. Retaining clip
5. Connecting rod
6. Small end needle bearing
7. Large end needle bearing
8. Crank pin
9. Dowel pin
10. Crank shim
11. Main bearing
12. Rotary valve
13. Valve collar
14. Crankshaft
15. Woodruff key
16. Primary drive gear
17. "O" ring

REPAIRS

PISTON, RINGS AND CYLINDER. After removing exhaust pipe, head and cylinder, the piston may be removed. Use the following repair specifications:

Ring end gap.....0.006-0.014 inch
Piston skirt to cylinder clearance—
Electric start
models .....0.001-0.0012 inch
Others .....0.0016-0.0018 inch
Cylinder taper or out
of round limit .....0.002 inch

Piston is installed with arrow toward front of engine (exhaust side). Chrome ring is used in top groove. Marks on rings should be toward top. Measure piston skirt for cylinder clearance check ⅜ inch from bottom of piston at right angles to piston pin hole. Later models are equipped with Keystone type piston and rings.

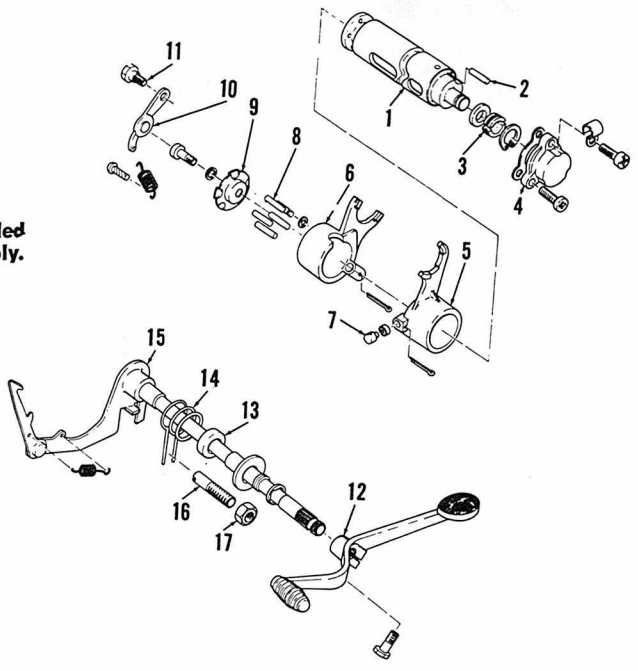


Fig. Y13-11 — Exploded view of shifter assembly.

1. Shift cam
2. Dowel pin
3. Shift cam holders
4. Shift cam plug
5. First shift fork
6. Second shift fork
7. Cam follower pin
8. Locating pin
9. Side plate
10. Lever stopper assembly
11. Stopper bolt
12. Change pedal
13. Oil seal
14. Shift return spring
15. Change arm assembly
16. Eccentric screw
17. Lock nut

Do not attempt to use these pistons or rings with a standard piston or ring set. A Keystone piston will have a letter "K" stamped on the top and a Keystone ring will be marked "1N" or "1T" for top ring and "2N" or "2T" for bottom ring. Refer to Fig. Y13-9. Torque cylinder head retaining nuts to 5.5-8.6 foot-pounds using a cross pattern to prevent warpage.

CRANKCASE AND GEARBOX. Engine must be removed from frame to disassemble it completely. Remove engine right cover, clutch and rotary valve assembly. Remove engine left cover, flywheel magneto and snap ring from shifter shaft. Pull shifter shaft out right side of engine case. Gear shifter stopper bolt (11—Fig. Y 13-11) should be removed before splitting engine cases. Check rotary valve cover for torn seals and rotary valve for damage. The transmission and crankshaft should stay in left side as cases are separated. Reinstall transmission and shifter as a unit with transmission in neutral position. If transmission is left in gear, damage to shifting fork is probable.

The crankshaft should not be disassembled unless the proper tools are available to reassemble it correctly. Use the following specifications:

Maximum crankshaft runout ..... 0.0012 inch
Small end rod shake .....0.079 inch
Large end of rod to crank cheek clearance ...0.004-0.011 inch

Installation of seals or bearings in engine cases can be eased by heating the cases to approximately 250-300° F. then pressing in cold bearings or seals.

CLUTCH. Clutch is a wet multi-disc unit. Clutch in G6-S models has five molded cork friction plates and five steel plates. All others use three friction and three steel plates. Standard free length of a clutch spring is 1.063 inch (27 MM). Spring should be renewed if less than 1.023 inch (26 MM) long. A new friction disc is 0.138 inch (3.5 MM) thick. Discs should be renewed if burned, warped or worn to less than 0.126 inch (3.2 MM) thick.

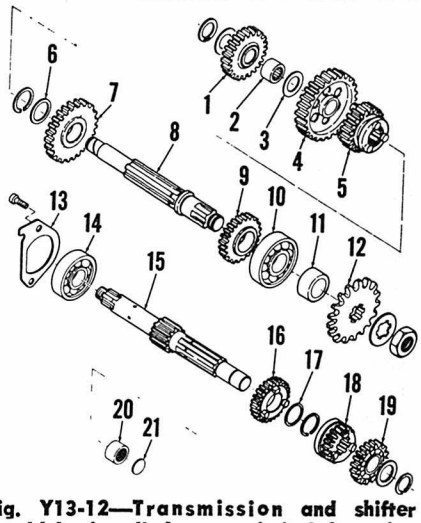


Fig. Y13-12—Transmission and shifter should be installed as a unit in left engine case.

1. Kick idle gear
2. Bearing
3. Drive axle shim
4. First gear
5. Third gear
6. Gear hold washer
7. Second gear
8. Drive axle
9. Fourth gear
10. Ball bearing
11. Distance collar
12. Drive sprocket
13. Bearing cover plate
14. Ball bearing
15. Main axle
16. Third pinion gear
17. Washer
18. Second pinion gear
19. Fourth pinion gear
20. Bearing
21. Blind plug

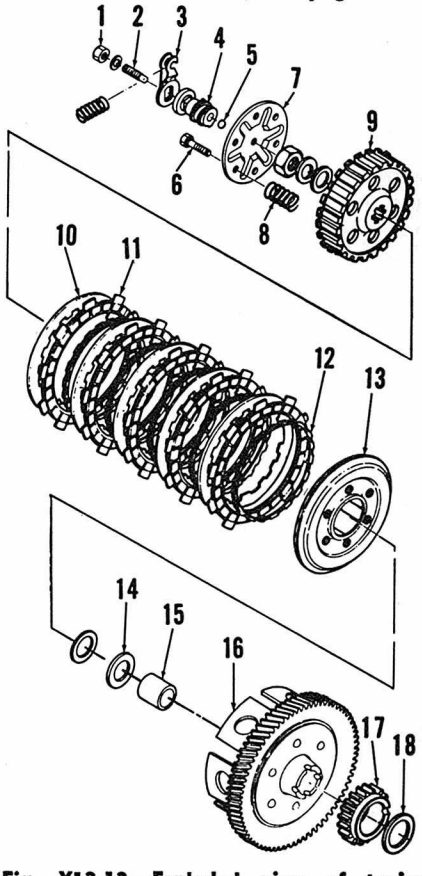


Fig. Y13-13—Exploded view of typical clutch assembly used in G6-S model. Unit used in other models is of similar construction.

1. Nut
2. Adjusting screw
3. Push lever
4. Push screw
5. Steel ball
6. Screw
7. Pressure plate
8. Clutch spring
9. Clutch hub
10. Steel plate
11. Friction disc
12. Cushion ring
13. Pressure plate
14. Thrust washer
15. Spacer
16. Driven gear assembly
17. Kick pinion gear
18. Thrust plate

SERVICE FUNDAMENTALS

TROUBLE SHOOTING

Most performance problems such as failure to start, failure to run properly or missing out are caused by malfunction of the ignition system or fuel system. The experienced serviceman generally develops and follows a logical sequence in trouble shooting which will most likely lead him quickly to the source of trouble. One such sequence might be as follows:

FAILS TO START

1. Remove and examine spark plugs. If fuel is reaching the cylinder in proper amount, there should be an odor of gasoline on the plugs if they are cold. Too much fuel or oil can foul the plugs causing engine not to start. Fouled plugs are wet in appearance and easily detected. The presence of fouled plugs is not a sure indication that the trouble has been located, however. The engine might have started before fouling occurred if ignition system had been in good shape.

2. With spark plug removed, hold wire about ⅛ to ¼ inch away from and unpainted part of the cylinder head or cylinder and crank the engine sharply. The resulting spark may not be visible in bright daylight but a distinct snap should be heard as the spark jumps the gap.

If carburetor and ignition were both in apparently good condition when tested in (1) and (2) above, check other elements of the engine such as crossed spark plug wires, improper timing, etc. A systematic search will usually pinpoint the cause of trouble with a minimum delay or confusion.

DIAGNOSIS. If the presence of fuel was not apparent when checked as in (1) above; and the spark seemed satisfactory when checked as in (2), systematically check the fuel system for the cause of trouble. The following are some of the probable causes:

a. No fuel in tank
b. Fuel shut off valve closed
c. Fuel tank vent closed or plugged
d. Carburetor not primed
e. Choke or starting valve incorrectly used or malfunctioning.
f. Water or dirt in the fuel
g. Fuel line pinched or kinked
h. Clogged fuel shut off, fuel line or filter
i. Carburetor dirty or incorrectly adjusted.

If ignition trouble was indicated when checked as outlined in (2) above, check the electrical system for causes of trouble. Some probable causes are as follows:

a. Battery voltage low (Battery ignition models)
b. Ignition breaker points improperly adjusted
c. Shorted wire or stop switch
d. Open (broken) wire
e. Loose or corroded connections
f. Condenser shorted
g. Improperly mounted coil (Incorrect gap between primary coil and flywheel magnets)
h. Flywheel loose
i. Faulty coil
j. Ignition breaker points stuck open
k. Ignition breaker point contacts pitted, burned or dirty

(New ignition points are sometimes coated with protective oil).

FAULTY RUNNING ENGINE

The diagnosis of trouble in a running engine depends on experience, knowledge and acute observation. A continuous miss on one cylinder of a two cylinder engine can usually be isolated by observing the items listed in the previous paragraphs FAILS TO START.

Faults such as not enough power (or speed) can usually be traced to improper tuning. Make sure that air filter is clean and in good condition and the exhaust pipe and muffler is open (not clogged). Ignition timing and carburetor(s) must be correctly adjusted. The carburetor jet sizes, clip position in valve needle and idle mixture needle settings listed in the individual service sections in this manual are "normal" settings. Altitude above sea level, riders weight, driving habits etc. may require different sizes and settings than those listed. On motorcycles with two carburetors, make certain that the throttles are synchronized to open exactly the same amount. Ignition timing on two cylinder motorcycles must be the same for each cylinder. In addition to normal engine tuning procedures, check the following: Sprocket sizes incorrect. Drive chain too tight or too loose. Tire pressure too low. Brakes dragging. Clutch slipping. Damaged pistons, rings and/or cylinders. Loose cylinder head nuts or leaking head gasket. Leaking crankcase seals.

SPECIAL NOTES ON TROUBLE SHOOTING

ENGINE OVERHEATS. The following lists some probable causes of engine overheating.

1. Check for dirt or debris accumulated on or between cooling fins on cylinder and head.
2. Too lean fuel-air adjustment of carburetor.
3. Improper ignition timing. Check breaker point gap and ignition timing.
4. Two-cycle engines being operated with an improper fuel-lubricating oil mixture may overheat due to lack of lubrication; refer to appropriate engine service section in this manual for recommended lubrication requirements.
5. Missing or bent shields or blower housing. (On models with cooling blower, never attempt to operate without all shields and blower housing in place.)
6. Engines being operated under loads in excess of rated engine horsepower or at extremely high ambient (surrounding) air temperatures may overheat.

TWO-STROKE CYCLE ENGINE EXHAUST PORTS. Two-stroke engines, and especially those being operated on an overly rich fuel-air mixture or with too much lubricating oil mixed with the fuel, will tend to build up carbon in the cylinder exhaust ports. It is recommended that the muffler be removed periodically and the carbon removed from the exhaust ports, exhaust pipe and muffler.

On two-stroke cycle engines that are hard to start, or where complaint is loss of power, it is wise to remove the exhaust pipe and inspect the exhaust ports for carbon build up.

TWO-STROKE CYCLE ENGINES WITH REED VALVE. On two-stroke cycle engine, the incoming fuel-air mixture must be compressed in engine crankcase in order for the mixture to properly reach the engine cylinder. On engines utilizing reed type carburetor to crankcase intake valve, a bent or broken reed will not allow compression build up in the crankcase. Thus, if such an engine seems otherwise OK, remove and inspect the reed valve unit. Refer to appropriate engine repair section in this manual for information on individual two-stroke cycle engine models.

SPARK PLUG

The appearance of the spark plug will be altered by use and careful examination of the plug tip can contribute useful information. It must be remembered that contributing factors differ in two stroke cycle and four stroke cycle engine operation and although the appearance of two spark plugs may be similar, the corrective measures may depend on whether the engine is of two-cycle or four-cycle design. The accompanying pictures (Figs. 2-1 thru 2-8) are provided by Champion Spark Plug Company to illustrate typical conditions. Listed also are the probable causes and suggested corrective measures.

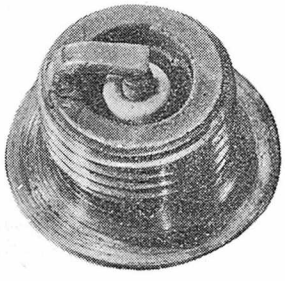


Fig. 2-1 — Normal plug appearance. Insulator is light tan to gray in color and electrodes are not burned. Renew plug at regular intervals as recommended by manufacturer.

Fig. 2-2—Appearance of spark plug indicating cold fouling. Cause of cold fouling may be use of a too-cold plug, excessive idling or light loads, carburetor choke (or starting valve) out of adjustment, carburetor adjusted to "rich" or air filter dirty or wet.

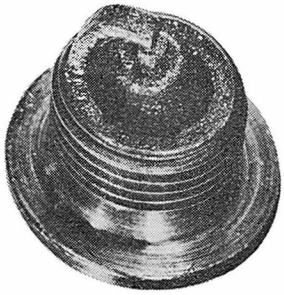


Fig. 2-3—Appearance of spark plug indicating wet fouling; a wet, black oil film is over entire firing end of plug. Cause may be incorrect fuel-oil ratio, incorrectly adjusted oil pump or leakage of transmission oil into crankcase (through crankshaft seals).

MAINTENANCE

SPARK PLUG

The recommended type of spark plug, heat range and electrode gap is listed in the appropriate MAINTENANCE section for each motorcycle. Under light loads, low speeds or only short trips, a spark plug of the same size with a higher (hotter) heat range may be installed. If subjected to heavy loads, high speeds and/or long (cross country) trips, a colder plug may be necessary.

The spark plug electrode gap should be adjusted on most plugs by bending the ground electrode. Refer to Fig. 2-10. The ground electrode for some

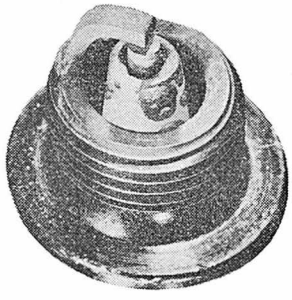


Fig. 2-4—Appearance of spark plug indicating splash fouling. Carbon deposits which have accumulated during a long period may be loosened suddenly upon installation of new spark plugs. When the newly tuned engine is placed under load, excess carbon deposits shed off the piston and are thrown against the hot insulator surface. These deposits can foul the plug, but can be removed from the plug by cleaning.

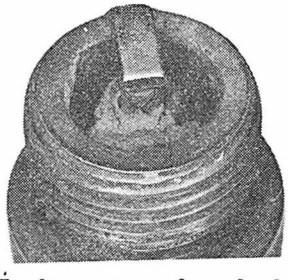


Fig. 2-5—Appearance of spark plug indicating core bridging. This condition is similar to, and caused by, the same combustion chamber deposits that cause splash fouling (Fig. 2-4). When the deposits become lodged between the insulator and the spark plug shell, an electrical bridge is formed, resulting in plug misfire.

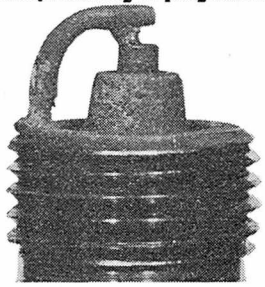


Fig. 2-6 — Gap bridging usually results from excessive carbon deposits from prolonged usage, improper oil or incorrect oil to fuel ratio or high-speed operation immediately upon starting.

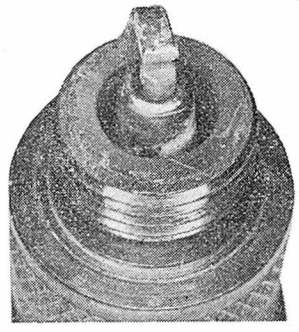


Fig. 2-7—If plug has been in use for some time electrodes may be badly eroded. Could be caused by lean carburetor mixture, fast timing, overloading, improper cooling or spark plug heat range too hot.

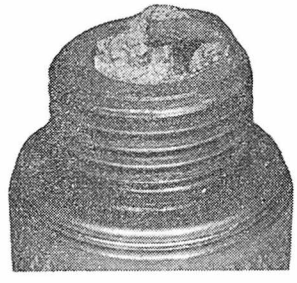


Fig. 2-8 — Gray, metallic aluminum deposits on plug. This condition is caused by internal engine damage. Engine should be overhauled and cause of damage corrected.

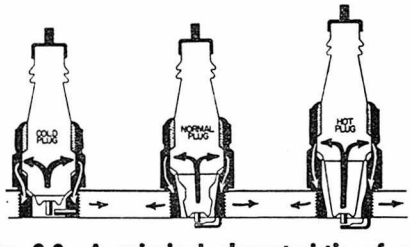


Fig. 2-9—A principal characteristic of a "COLD" plug is that it has a shorter path for heat to travel from the insulator tip to the metal shell than the "HOT" plug shown at the right.

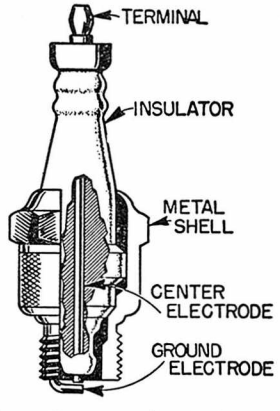


Fig. 2-10 — Cross sectional view of spark plug showing typical construction and nomenclature. Recommended gap between center electrode and ground electrode is listed in appropriate section for each motorcycle.

extremely cold (racing) plugs is constructed as shown by "COLD PLUG" in Fig. 2-9 and electrode gap is preset or adjusted with a special tool.

Spark plugs are usually cleaned by abrasive action commonly referred to as "sand blasting." Actually, ordinary sand is not used, but a special abrasive which is nonconductive to electricity even when melted, thus the abrasive cannot short out the plug current. Extreme care should be used in cleaning the plugs after sand blasting; however, as any particles of abrasive left on the plug may cause damage to piston rings, piston or cylinder walls.

After plug is cleaned by abrasive, and before gap is set, the electrode surfaces between the grounded and insulated electrodes should be cleaned and returned as nearly as possible to original shape by filing with a point file. Failure to properly dress the points can result in high secondary voltage requirements, and misfire of the plugs.

CAUTION: Use special caution when filing the electrodes of spark plugs using precious metal electrodes. Fig. 2-11A shows the center electrode of a Champion "Gold Palladium" spark plug which has been bent by filing. Precious metal electrodes are usually softer than normal plugs and easily damaged by filing. Electrode gap for plugs with precious metal electrodes can be set for less gap than other spark plugs.

Fig. 2-11—View of a Champion J-8J spark plug (left) and a similar J-8 plug on right. The J suffix indicates that ground electrode is slightly shorter as shown Plugs with short ground electrode usually require less ignition voltage than standard type and lessen the chance of bridging between electrodes. The short ground electrode operates cooler than standard length even though plugs are considered same heat range.

The following may be used to compare standard types to "Gold Palladium" spark plugs:

14mm / ⅛" Reach			14mm / .472" Reach	
—	—	HOT	—	—
J-8J	—		L-86	—
—	UJ-11G		—	—
J-7J	—		—	—
—	UJ-7G		L-81	L-6G
J-6J	—		—	—
—	—		—	—
J-4J	—		L-78	L-3G
—	—		—	—
J-57R	—	COLD	L-77J	L-2G

14mm / ¼" Reach			18mm / .445" Reach	
—	—	HOT	K-13	—
—	—		—	K-12G
N-5	—		K-9	—
—	—		--	K-8G
N-4	N-4G		K-8	—
—	—		—	K-5G
N-3	N-3G		K-7	—
—	—		—	—
N-2	N-2G		K-60R*	K-3G
—	—	COLD	K-57R*	K-2G

* .500" Reach

It is usually necessary to clean or renew spark plugs shortly after overhauling the engine. The oil used to coat engine parts during assembly may foul the plugs quickly.

CARBURETOR

The bulk of carburetor service consists of cleaning, inspection and adjustment. After considerable service it may become necessary to overhaul the carburetor and renew worn parts to restore original operating efficiency. Although carburetor condition affects engine operating economy and power, ignition and engine compression must also be considered to determine and correct causes.

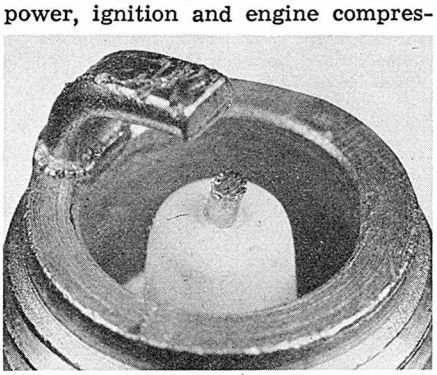


Fig. 2-11A—Use care to prevent damage to the electrodes, especially those made of precious metals. The center electrode shown has been roughened, shortened and bent by filing. The plug shown is a Champion "Gold Palladium" type.

Before dismantling carburetor for cleaning and inspection, clean all external surfaces and remove accumulated dirt and grease. If fuel starvation is suspected, all filters in carburetor, shut-off valve and tank should be inspected. Because of inadequate fuel handling methods, rust and other foreign matter may sometimes block or partially block these filters. Under no circumstances should these filters be removed from the fuel system. If filters are removed, the blockage will most likely occur within the carburetor and cleaning will be frequent and more difficult.

Refer to appropriate engine repair section for carburetor exploded or cross sectional views. Disassemble the carburetor and note any discrepancies which may cause a malfunction. Thoroughly clean and inspect every part. Wash jets and passages and blow clear with clean, dry, compressed air. NOTE: Do not use a drill or wire to clean jets, because the possible enlargement of holes will disturb calibration. Measurement of jets to determine extent of wear is difficult and installation of new parts usually assures satisfaction. Sizes are usually stamped on each jet.

Inspect float pin and needle valve for wear and renew if necessary. Check metal floats for leaks and dual type floats for alignment of float sections. Check fit of all moving parts. Binding or excessive clearance of all parts should be corrected. Mixture adjustment needles must not be worn or grooved.

When reassembling, be sure float level (or fuel level) is properly adjusted as listed in the CARBURETOR paragraph of the appropriate engine repair section.

Normal adjustment will be limited to replacement of recommended standard size jets and turning idle mixture needle (screw); however, the following procedure may be useful for carburetors that are particularly hard to adjust. Refer to the appropriate CARBURETOR paragraph within the specific repair section for further explanation and views of carburetors.

Idle mixture adjustment needle controls mixture from idle to approximately ⅛ throttle opening. Throttle slide cut-away (Fig. 2-12), on variable venturi carburetors, controls mixture from ⅛ to ¼ throttle opening. A larger cut-away leans the mixture in this range. The valve needle located

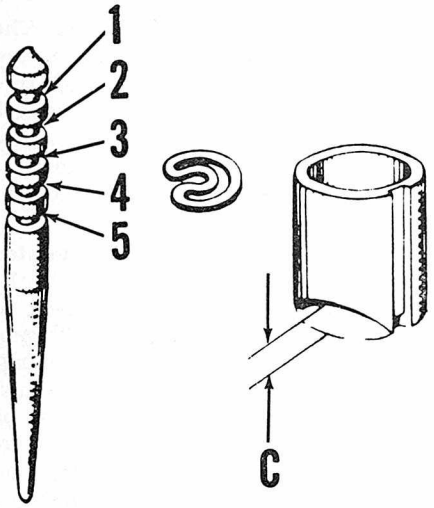


Fig. 2-12—View of slide type throttle valve. A large cut-away (C) leans the mixture in the 1/8-1/4 throttle range. Installation of clip in a groove nearer the top (such as No. 1) of valve needle leans the mixture in the 1/4-3/4 throttle opening range.

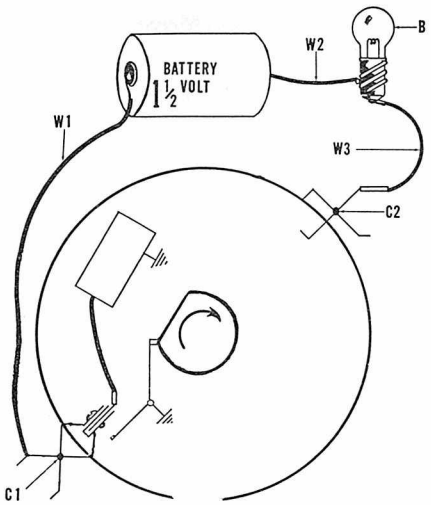


Fig. 2-13—Drawing of a simple test lamp for checking ignition timing and various other complete circuits.

in sliding venturi, controls mixture from ¼ to ¾ throttle opening. Lowering the needle in the slide leans mixture. The size of the main jet controls mixture from ¾ to full open throttle.

When two carburetors are used on two cylinder engines, mixture adjustments are sometimes facilitated by removing the spark plug wire from the other cylinder while tuning. Setting for the two carburetors should not differ greatly. Large differences in mixture settings for proper engine operation indicates air leak in inlet manifold, faulty carburetor or engine internal faults.

IGNITION AND ELECTRICAL

The fundamentals of ignition and electrical system service are outlined in the following paragraphs. Refer to the appropriate heading for type of system being inspected or overhauled. A simple, easily constructed test lamp is shown in Fig. 2-13. A similar test lamp or Ohmmeter can be used to facilitate repair.

Battery Ignition

Repair is usually limited to renewal of breaker points and/or condenser and adjustment of ignition timing. Refer to the appropriate MAINTENANCE section for recommended breaker point gap and ignition timing for each model.

BREAKER POINTS. Using a small screwdriver, separate and inspect condition of contacts. If burned or deeply pitted, points should be renewed. If contacts are clean to grayish in color, disconnect condenser and coil lead wires from breaker point terminal. Connect one lead (C1—Fig. 2-13) to the insulated breaker point terminal and the other (C2) to engine (ground). Light should burn with points closed and go out with points open. If light does not burn, little or no contact is indicated and points should be cleaned or renewed and contact maximum gap should be reset. NOTE: In some cases, new breaker point contact surfaces may be coated with oil or wax. If light does not go out when points are opened, breaker arm insulation is defective and points should be renewed.

Adjust breaker point gap as follows unless manufacturer specifies adjusting breaker gap to obtain correct ignition timing. First, turn engine so that points are closed to be sure that the contact surfaces are in alignment and seat squarely. Then, turn engine so that breaker point opening is maximum and adjust breaker gap to manufacturer's specification. Be sure to recheck gap after tightening breaker point base retaining screws.

CONDENSER. To check condition of the condenser without special test equipment, proceed as follows: The condenser case and wire should be visually checked for any obvious damage. Connect one end of the test lamp (C1—Fig. 2-13) to terminal at end of condenser wire and other end to condenser case. If light goes on, condenser is shorted and should be renewed. It is usually a good practice to renew condenser when new breaker points are renewed.

IGNITION COIL. If a coil tester is available, condition of coil can be checked. However, if tester is not available, a reasonably satisfactory performance test can be made as follows:

Disconnect high tension wire from spark plug. Turn engine so that cam has allowed breaker points to close. With ignition switch on, open and close points with small screwdriver while holding high tension lead about ⅛ to ¼-inch away from engine ground. A bright blue spark should snap across the gap between spark plug wire and ground each time the points are opened. If no spark occurs, or spark is weak and yellow-orange, renewal of the ignition coil is indicated.

Sometimes, an ignition coil may perform satisfactorily when cold but fail after engine has run for some time and coil is hot. Check coil when hot if this condition is indicated.

IGNITION TIMING. On some engines, ignition timing is non-adjustable and a certain breaker point gap is specified. On other engines, timing is adjustable by changing the position of the stator plate with a specified breaker point gap or by simply vary-

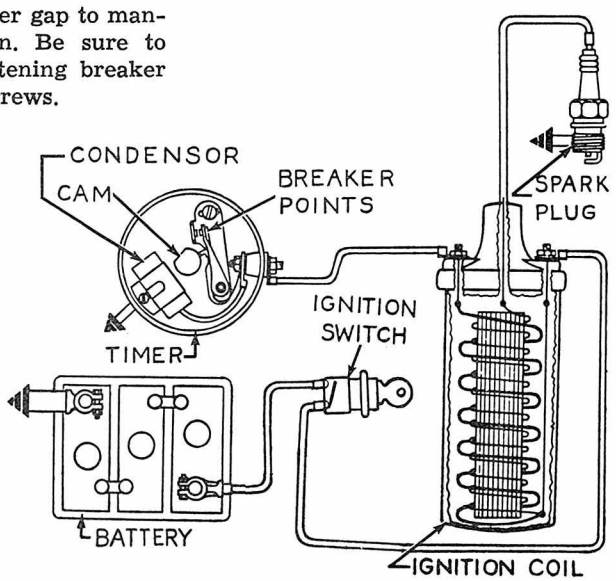


Fig. 2-14—Drawing of a typical battery ignition system for single cylinder engine. Ignition switch closes to complete the circuit.

ing the breaker point gap to obtain correct timing. Ignition timing is usually specified either in degrees of engine (crankshaft) rotation or in piston travel before the piston reaches top dead center position.

Some engines may have timing marks or locating pin to locate the crankshaft at proper position for the ignition spark to occur (breaker points begin to open). If not, it will be necessary to measure piston travel or install a degree wheel on engine crankshaft. Refer to Figs. 2-15 and 2-16.

A timing light as shown in Fig. 2-13 is a valuable aid in checking or adjusting engine timing. After disconnecting the ignition coil lead from the breaker point terminal, connect the leads of the timing light as shown. If timing is adjustable by moving the stator plate, be sure that the breaker point gap is adjusted as specified. Then, to check timing, slowly turn engine in normal direction of rotation past the point at which ignition spark should occur. The timing light should be on, then go out (breaker points open) just as the correct timing location is passed. If not, turn engine to proper timing location and adjust timing by relocating the breaker point base plate or varying the breaker contact gap as specified by appropriate section for each model. Recheck timing to be sure adjustment is correct.

If ignition is equipped with advancing mechanism (manual control or automatic, centrifugal advance), make sure timing is checked when fully advanced. On some models, timing can be checked using an automotive, power timing light when engine is running.

Flywheel Magneto

Repair is usually limited to renewal of breaker points and/or condenser and adjustment of ignition timing. Refer to the appropriate MAINTENANCE section for recommended breaker point gap and ignition timing for each model.

BREAKER POINTS. The same general service procedure is used as in the preceeding paragraph for BATTERY IGNITION. Holes are usually provided in the flywheel for adjustment, however flywheel usually must be removed for renewal of ignition points.

CONDENSER. The same general procedure is used to check condenser as outlined in previous BATTERY IGNITION system. Condenser is usually located under the flywheel.

ARMATURE AIR GAP. To fully concentrate the magnetic field of the flywheel, magnets pass as closely to the armature core as possible without danger of metal to metal contact. The clearance between the flywheel magnets and the legs of the armature core is called the armature air gap.

On magnetos where the armature and high tension coil are located outside of the flywheel rim, adjustment of the armature air gap is made as follows: Turn the engine so that the flywheel magnets are located directly under the legs of the armature core and check the clearance between the armature core and flywheel magnets. If the measured clearance is not within manufacturers specifications, loosen the armature mounting screws and place shims of thickness equal to minimum air gap specification between the magnets and armature core. The magnets will pull the armature core against the shim stock. Tighten the armature core mounting screws, remove the shim stock and turn the engine through several revolutions to be sure the flywheel does not contact the armature core.

Where the armature core is located under or behind the flywheel, the following methods may be used to check and adjust armature air gap: On some engines, slots or openings are provided in the flywheel through which the armature air gap can be checked. Some engine manufacturers provide a cut-away flywheel that can be installed temporarily for checking the armature air gap.

Another method of checking the armature air gap is to remove the flywheel and place a layer of plastic tape equal to the minimum specified air gap over the legs of the armature core. Reinstall flywheel and turn engine through several revolutions and remove flywheel; no evidence of contact between the flywheel magnets and plastic tape should be noticed. Then cover the legs of the armature core with a layer of tape of thickness equal to the maximum specified air gap; then, reinstall flywheel and turn engine through several revolutions. Indication of the flywheel magnets contacting the plastic tape should be noticed after the flywheel is again removed. If the magnets contact the first thin layer of tape applied to the armature core legs, or if they do not contact the second thicker layer of tape, armature air gap is not within specifications and should be adjusted. NOTE: Before loosening armature core mounting screws, scribe a mark on mounting plate against edge of armature core so that adjustment of air gap can be gaged.

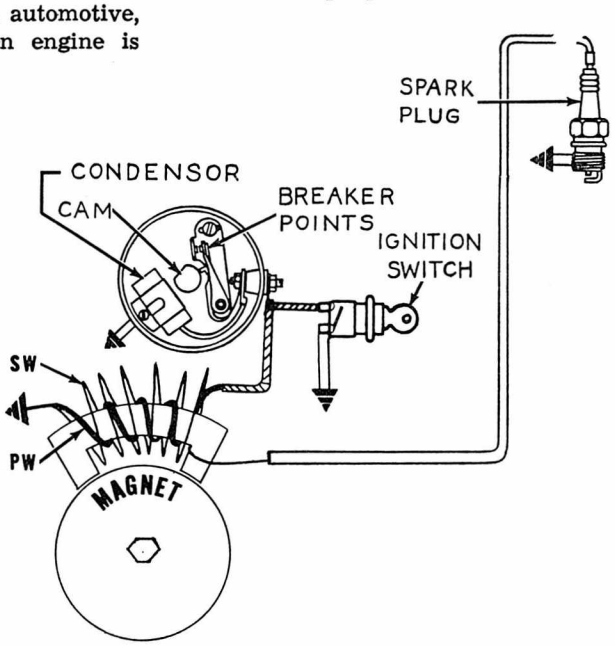


Fig. 2-14A—Drawing of a typical magneto ignition system. Coil primary winding is shown at (PW) and secondary winding at (SW). Ignition switch grounds the primary circuit to stop engine.

MAGNETO EDGE GAP. The point of maximum acceleration of the movement of the flywheel magnetic field through the high tension coil (and therefore, the point of maximum current induced in the primary coil windings) occurs when the trailing edge of the flywheel magnet is slightly past the last leg of the armature core. The exact point of maximum primary current is determined by using electrical measuring devices, the distance between the trailing edge of the flywheel magnet and the leg of the armature core at this point is measured and becomes a service specification. This distance, which is stated either in thousandths of an inch or in de-

grees of flywheteel rotation, is called the Edge Gap or "E" Gap.

For maximum strength of the ignition spark, the breaker points should just start to open when the flywheel magnets are at the specified edge gap position. Usually, edge gap is non-adjustable and will be maintained at the proper dimension if the contact breaker points are adjusted to the recommended gap and the correct breaker cam is installed. However, magneto edge gap can change (and spark intensity thereby reduced) due to the following:

a. Flywheel drive key sheared
b. Flywheel drive key worn (loose)
c. Keyway in flywheel or crankshaft worn (oversized)
d. Loose flywheel retaining nut which can also cause any above listed difficulty.
e. Excessive wear on breaker cam
f. Breaker cam loose on crankshaft
g. Excessive wear on breaker point rubbing block so that points cannot be properly adjusted.

Unit Type Magneto

Improper functioning of the carburetor, spark plug or other components often causes difficulties that are thought to be an improperly functioning magneto. Since a brief inspection will often locate other causes for engine malfunction, it is recommended that one be certain the magneto is at fault before opening the magneto housing.

BREAKER POINTS AND CONDENSER. The same general procedure is used to service and check as outlined in previous paragraphs for BATTERY IGNITION system. Usually complete magneto housing is rotated when adjusting ignition timing.

COIL. The ignition coil can be tested without removing the coil from the housing. The instruction provided with coil tester should have coil test specifications listed.

ROTOR. Usually, service on the magneto rotor is limited to renewal of bushings or bearings, if damaged. Check to be sure rotor turns freely and does not drag or have excessive end play.

MAGNETO INSTALLATION. When installing a unit type magneto on an engine, refer to IGNITION paragraph in appropriate engine repair section for magneto to engine timing information.

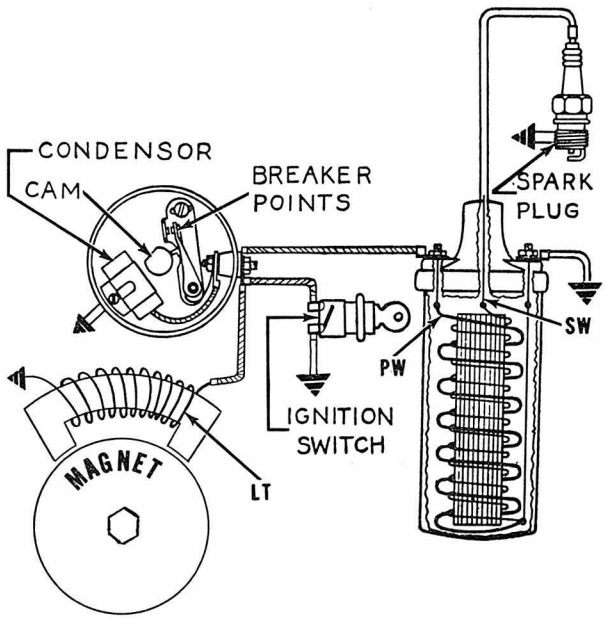


Fig. 2-14B—Drawing of a typical energy transfer ignition system. Low tension generating coil is shown at (LT). When breaker points are closed, current completes circuit through the points. When breaker points open, current rushes into the high tension coil primary winding (PW) and induces voltage in the secondary (SW). Ignition switch grounds the low tension circuit to stop engine.

Energy Transfer System

The energy transfer ignition system operates very much as the previously described flywheel magneto system except the components are not in one area of the engine. Refer to Fig. 2-14B. The rotor (rotating magnet) is attached to the crankshaft with the low tension coil around it. As the magnet revolves, current generated in the low tension coil (LT) is grounded by the closed ignition breaker points. When the current generated in the low tension coil reaches its maximum voltage, the ignition points open causing a rapid build up of the primary current in the high tension ignition coil. The rapid build-up of current in the high tension coil primary windings (PW) induces a high tension current in the secondary windings (SW) in much the same way as the rapid collapse in a battery ignition system. A special high tension coil is used and cannot be interchanged with a battery ignition coil.

If the ignition timing cam and rotating magnet (rotor) are separately mounted, each must be individually timed with crankshaft to obtain the correct magneto edge gap. Refer to preceding paragraph in FLYWHEEL MAGNETO section for explanation of EDGE GAP. On models where the rotor is keyed to the crankshaft, advancing the time of ignition breaker point opening causes a low voltage in the primary winding resulting in insufficient secondary voltage. If the rotor is moveable on the crankshaft, it is important that the rotor position and ignition breaker point opening not be changed from the recommended settings listed in the repair section of this manual.

Make certain that the high tension coil is securely attached. On many

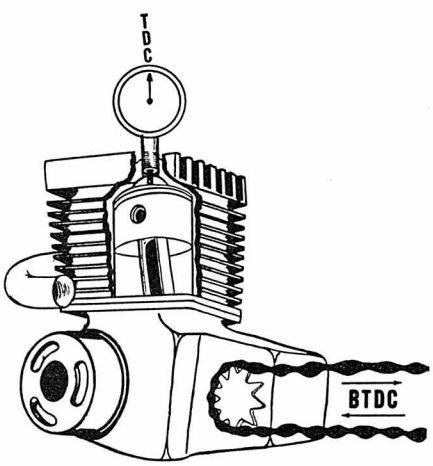


Fig. 2-15 — On some engines, it will be necessary to measure piston travel with rule, dial indicator or special timing gage when adjusting or checking ignition timing. Arrows show direction to move chain to position piston Before Top Dead Center after TDC has been located.

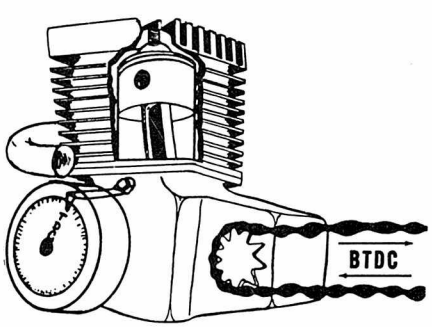


Fig. 2-16—View of typical degree wheel installation for checking ignition timing. Degree wheel can also be used for checking rotary valve timing and piston port opening.

models, the attaching screws provide the ground for the high tension coil. If not mounted correctly, ignition will be affected.

Capacitor Discharge System

This This system differs radically from conventional units in that a relatively high voltage current is fed into a capacitor which discharges through a pulse transformer (ignition coil) to generate the ignition spark. The secondary current is induced by the rapid build-up rather than by collapse of the primary current. The result is a high-energy ignition spark ideally suited to high-speed, two-stroke engine operation.

One development which made the new systems possible was the introduction of semi-conductors suitable for ignition system control. While solid state technology and the capacitor discharge system are not interdependent they are uniquely compatible and each has features which are desirable from the standpoint of reliability and performance.

A flywheel magneto is most generally used as the primary current source in engines of the size and type found on motorcycles because of the relatively high voltage obtainable and compact, light-weight parts available If battery current is used as the power source, it must be amplified or converted to obtain the necessary voltage.

The introduction of the new ignition systems is bringing unfamiliar words into use which might be defined in the following non-technical terms:

CAPACITOR. The storage capacitor, or condenser.

DIODE. A device which will allow electrical current to flow in one direction but will block a reverse flow.

GATE CONTROLLED SWITCH. A semi-conductor which will pass the flow of electrical current in one direction only when a second, small "TRIGGER CURRENT" opens the "GATE". Current will not flow in the reverse direction at any time. Properly called "GATE CONTROLLED SILICON RECTIFIER". Sometimes called "SCR".

PULSE TRANSFORMER. Similar in purpose, and sometimes in appearance, to the ignition coil of a conventional ignition system. Contains the primary and secondary ignition coils and converts the primary pulse current into the secondary ignition current which fires the plug. Cannot be interchanged with regular ignition coil.

RECTIFIER. Any device which allows the flow of current in one direction only, or converts Alternating Current to Direct Current. Diodes are sometimes used in combination to form a BRIDGE RECTIFIER.

SCR. See GATE CONTROLLED SWITCH.

SEMI-CONDUCTOR. Any of several materials which permit partial or controlled flow of electrical current. Used in the manufacture of Diodes, Rectifiers, SCR's, Thermistors, Thyristors, etc.

SILICON SWITCH. See GATE CONTROLLED SILICON SWITCH.

SOLID STATE. That branch of electronic technology which deals with the use of semi-conductors as control devices. See SEMI-CONDUCTOR.

THERMISTOR. A solid state regulating device which decreases in resistance as its temperature rises. Used for "Temperature Compensating" a control circuit.

THYRISTOR. A "Safety Valve" placed in the circuit which will not pass current in either direction but is used to provide surge protection for the other elements.

TRIGGER. The timed, small current which controls, or opens, the "GATE", thus intitiating the spark.

ZENER DIODE. A Zener Diode will permit free flow of current in one direction, and will also permit current to flow in the opposite direction when the voltage reaches a pre-determined level.

Fig. 2-24A shows a circuit diagram of a typical single cylinder, capacitor discharge, breakerless ignition system using permanent flywheel magnets as the energy source. The magnets pass by the input generating coil (1) to charge the capaciator (6), then by the trigger coil (4) to open the gate and permit the discharge pulse to enter the pulse transformer (7) and generate the spark which fires the plug (8). Only half of the generated current passes through diode (3) to charge the capacitor. Reverse current is blocked by diode (3) but passes through diode (2) to complete the reverse circuit. Diode (2) may be a Zener Diode to limit the maximum voltage of the forward current. When the flywheel magnet passes by the trigger coil (4) a small electrical current is generated which opens the gate of the SCR (5) allowing the capacitor to discharge through the pulse transformer (7). The rapid voltage rise in the transformer primary coil induces a high-voltage secndary current which forms the ignition spark when it jumps the spark plug gap.

Generating System

FLYWHEEL ALTERNATORS. Alternating current is readily available on engines using a flywheel magneto or energy transfer ignition system by installing an additional armature core (lighting coil) in a position similar to the ignition coil. The principle of this type of system is similar to the flywheel magneto, however only one winding is necessary. The voltage and amperage can be limited by the resistance (length, diameter, etc.) of the wire used in the lighting coil windings and the alternating current (AC) generated is satisfactory for lighting requirements. However, if a battery is used, the generated Alternating Current must be changed to Direct Current (DC) usually via a rectifier.

RECTIFIER. Repair of a rectifier is limited to renewal of the unit, however certain precautions and inspections may be more easily accomplished after a brief description of its operation.

Direct current (DC), like the type available from a battery, has an established negative terminal and a positive terminal. Alternating current such as generated by a magneto or alternator changes polarity as the magnetic field of force is broken by the armature core (lighting coil). This simply means that one end of the coil wire is first negative then as the

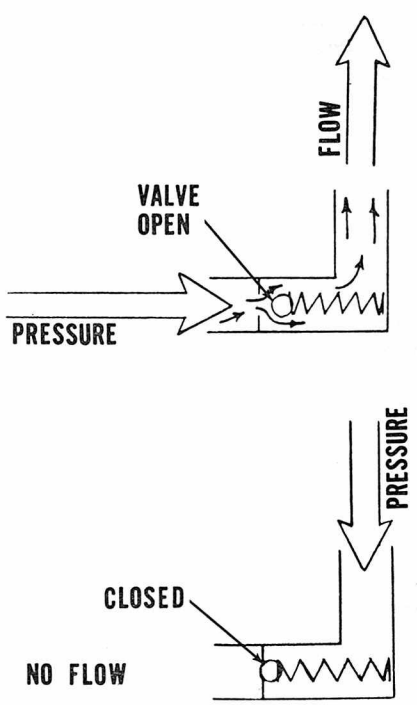


Fig. 2-17—A check valve can be installed in a pipe to allow a liquid to flow only in one direction. A rectifier serves a similar function in an electrical system.

flywheel (magnets) move on, the current reverses direction and the same end becomes positive. If the AC current were connected to a battery (DC), the current would first flow into the battery, then as the AC changed polarity (direction) it would withdraw the same amount.

Electricity in a wire is similar to liquid in a pipe. In a pipe, a check valve can be installed to allow a liquid to flow only in one direction

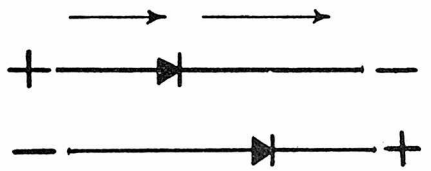


Fig. 2-18—A rectifier serves a similar function to the check valve in Fig. 2-17 allowing current to pass only in one direction.

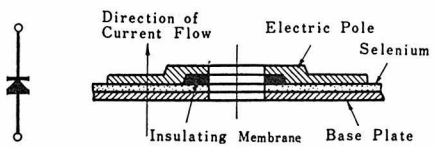


Fig. 2-19—Drawing showing the simplicity of typical modern rectifier construction. Type shown is Selenium.

Fig. 2-20 — Elaborate testing equipment shows alternating current as a wave. The curved "S" line between the dots is called a cycle.

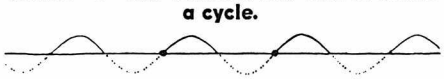


Fig. 2-21—Alternating current shown by dotted lines is unused when using only one rectifier.

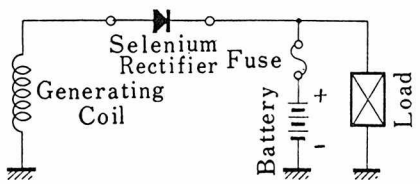
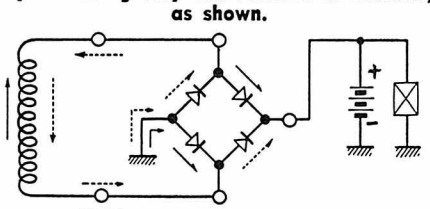


Fig. 2-22—A complete, simple electrical system using only one rectifier is basically as shown.



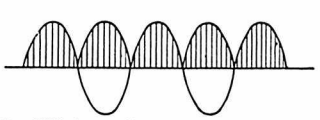


Fig. 2-23—Wiring diagram of full wave rectifing system. The four rectifiers shown are usually constructed as one unit.

as shown in Fig. 2-17. A rectifier is a similar valve for an electrical system Fig. 2-18. The simplicity of modern rectifier construction is shown in Fig. 2-19. The changing of AC polarity can be shown on elaborate testing equipment similar to drawing (Fig. 2-20. Where the curved line crosses the center line is the exact time that the current reverses polarity. Installation of a rectifier stops current flow in one direction so the current flow can be pictured as shown by the solid line in Fig. 2-21. Half of the current generated (shown by the broken lines) is lost.A typical, simple, complete system is shown in Fig. 2-22.

In order to use the current which is normally lost in the previously described simple system, a combination of rectifiers can be used. Normally they are constructed as one rectifing unit. Fig. 2-23 shows a typical complete system.

Rectifiers must be installed to allow current flow from the alternator into the battery. If the rectifier terminals are reversed, current from the battery will be fed into the lighting coil and coil and/or rectifier will be damaged by the resulting short circuit. The rectifier may be damaged if the system is operated without the battery connected or if battery terminals are reversed. Direction of current flow through the rectifier can be easily checked with a battery, light and wire

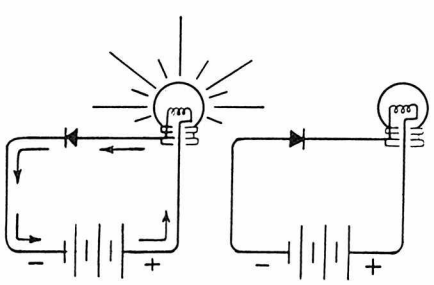
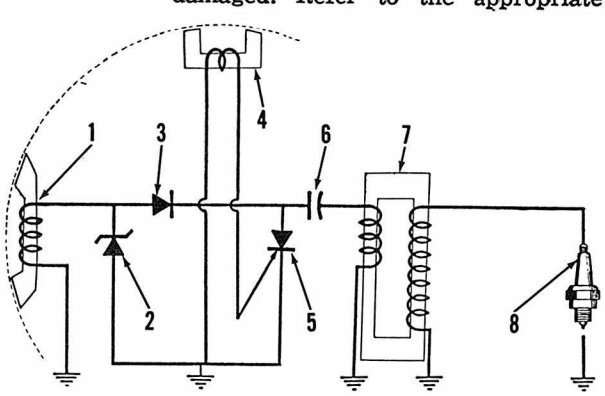


Fig. 2-24—A simple test can be made as shown on a rectifier to show which direction current can flow. Wires should be connected to rectifier so that current is allowed to pass as shown by arrows in wiring diagrams.

Fig. 2-24A — Schematic diagram of a typical Capacitor Discharge "Solid State" ignition system.

1. Generating coil
2. Zener diode
3. Diode
4. Trigger coil
5. Gate Controlled Switch (SCR)
6. Capacitor
7. Pulse transformer (coil)
8. Spark plug



(or ohmmeter) as shown in Fig. 2-24.

If the rectifier will not pass current in either direction using the simple test shown in Fig. 2-24, or if light continues to burn with connections reversed, rectifier may be considered faulty. Paint should not be scraped from rectifier plates and plates should not be discolored (from heat) or bent. The center bolt torque is pre-set and should **NOT** be disturbed.

LUBRICATION

Refer to the appropriate MAINTENANCE section for each model for recommended type and quantity of lubrication oils used in engine, gear box and primary (engine to transmission) drive case.

OIL-FUEL RATIO. Some engines are lubricated by oil that is mixed with the fuel. It is important that the manufacturer's recommended oil to fuel ratio be closely followed. Excessive oil will cause low power, plug fouling and excessive carbon build-up. Insufficient amount of oil will result in inadequate lubrication and rapid internal damage. The recommended ratios and type of oil are listed in LUBRICATION paragraph of each Maintenance section. Oil should be mixed with gasoline in a separate container before it is poured into the fuel tank. The following table may be useful in mixing the correct ratio.

RATIO	Oil	Gasoline
1:14	½ Pint	.88 Gallon
1:15	½ Pint	.94 Gallon
1:16	½ Pint	1.0 Gallon
1:20	½ Pint	1.25 Gallons
1:24	½ Pint	1.5 Gallons
1:25	½ Pint	1.56 Gallons
1:50	½ Pint	3.13 Gallons

OIL PUMP ADJUSTMENT. Some models are equipped with a separate oil tank and pump for lubricating the engine. It is important that the oil pump is properly adjusted to provide the correct amount of oil. If the pump does not deliver the correct amount of oil, the engine may be damaged. Refer to the appropriate

engine section for adjustment procedure. It is recommened that adjustment be checked periodically to make sure that oil delivery is correct. Wear and/or control cable stretch will decrease the amount of oil delivered.

CLUTCH CONTROL

Clutch cable and/or control linkage is usually provided with adjustments to compensate for some stretch in cable and small amount of clutch plate wear. Clutch linkage should not prevent clutch from completely engaging and when the control is actuated, clutch should not drag. Refer to appropriate section for adjustment procedure and requirements of each model.

REPAIRS

Because of the close tolerance of the interior parts, cleanliness is of utmost importance. It is suggested that the exterior of the engine and all nearby areas be absolutely clean before any repair is started. Manufacturer's recommended torque values for tightening screw fasteners should be followed closely. The soft threads in aluminum castings are often damaged by carelessness in over-tightening fasteners or in attempting to loosen or remove seized fasteners.

DISASSEMBLY AND ASSEMBLY

When removing the cylinder head, loosen the screws evenly in a diagonal pattern to prevent warpage. After cylinder head is removed, carefully check for distortion using a lapping block or similar flat area.

Two or more identical pistons, rings, connecting rods and bearings may be used, but parts should never be interchanged when reassembling. As parts are removed, they should all be marked to identify the correct position. All wearing parts seat to the mating parts during operation. If parts are mixed during reassembly, a new wear pattern is established and early failure may result.

A given amount of heat applied to aluminum or magnesium will cause it to expand a greater amount than will steel under similar conditions. Because of the different expansion characteristics, heat is usually recommended for easy installation of bearings, pins, etc., in aluminum or magnesium castings. Sometimes, heat can be used to free parts that are seized or where an interference fit is used. Heat, therefore, becomes a service tool and the application of heat, one of the required service techniques. An open flame is not usually advised because it destroys the paint and other protective coatings and because a uniform and controlled temperature with open flame is difficult to obtain. Methods commonly used for heating are: 1. In oil or water, 2. An electric oven or Kiln, 3. With a hot air gun. The use of hot water or oil gives a fairly accurate temperature control but is somewhat limited as to the size and type of part than can be handled. The hot air gun has advantages of control and portability. Two types of hot air guns are shown in Figs. 2-25 and 2-25A. Thermal crayons are available which can be used to determine the temperature of a heated part. These crayons melt when the part reaches specified temperature, and a number of crayons for different temperatures are available. Temperature indicating crayons are usually available at welding equipment supply houses.

The crankcase and combustion chambers must be sealed against pressure, vacuum and oil leakage. To assure a perfect seal, nicks, scratches and warpage are to be avoided, especially where no gasket is used. Slight imperfections can be removed by using a fine-grit sand-paper. Flat surfaces can be lapped by using a surface plate or a smooth piece of plate glass, and a sheet of fine sandpaper or lapping compound. Use a figure-eight motion with minimum pressure, and remove only enough metal to eliminate the imperfection. Bearing clearances must not be lessened by removing metal from the joint.

Use only the specified gaskets when re-assembling, and use an approved gasket cement or sealing compound unless the contrary is stated. Approved sealers such as "YAMAHA BOND" are available through the U.S. distributors. A different type sealer is usually suggested for use with gaskets than without gasket. All friction surfaces, including bearings and seals, should be coated with oil before assembling.

It is desirable to lock some threaded parts when assembling, using a product such as "Loctite". Some locations suggested for using "Loctite" are cylinder studs, bearing retainer plates, shift stops, suspension components attached to frame, etc.

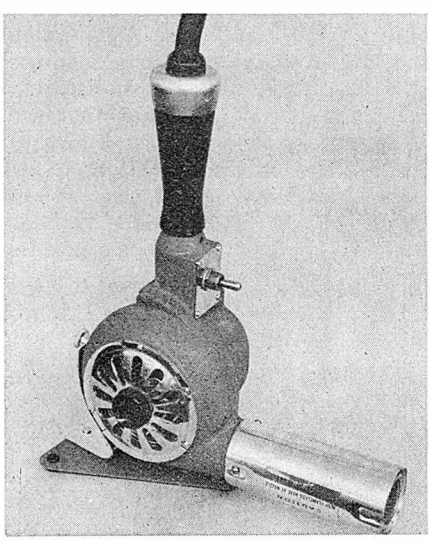


Fig. 2-25—The heat gun shown above has a built in fan. This heat gun and the one shown in Fig. 2-25A are available from Master Appliance Corp., 1745 Flett Ave., Racine, Wis. 53403.

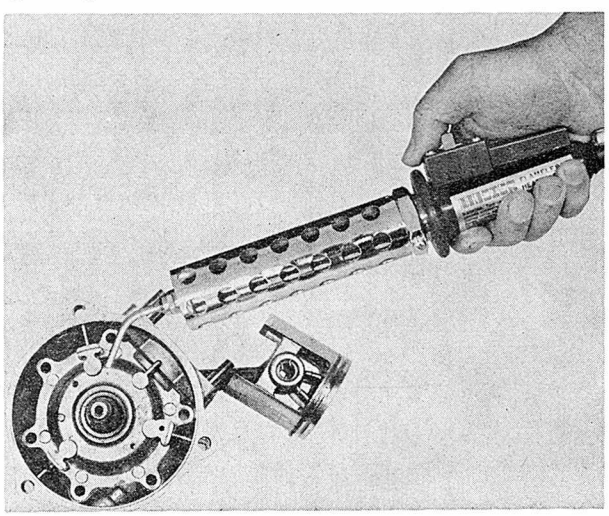


Fig. 2-25A—The heat gun shown uses compressed air from an outside source. The air is electrically heated and temperature is varied (up to 1000° F.) by controling air pressure.

REPAIRING DAMAGED THREADS

Special techniques must be developed in repair of engines of aluminum alloy or magnesium alloy construction. Soft threads in aluminum or magnesium castings are often damaged by carelessness in over-tightening fasteners or in attempting to loosen or remove seized fasteners. Manufacturer's recommended torque values for tightening screw fasteners should be followed closely.

Damaged threads in castings can be renewed by use of thread repair kits which are recommended by a number of manufacturers. Use of thread repair kits is not difficult, but instructions must be carefully followed. Refer to Figs. 2-26 through 2-28 which illustrate the use of Heli-Coil thread repair kits that are manufactured by the Heli-Coil Corporation, Danbury, Connecticut.

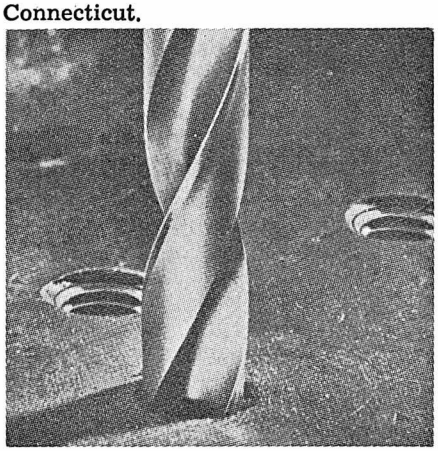


Fig. 2-26—First step in repairing damaged threads is to drill out old threads using exact size drill recommended in instructions provided with thread repair kit. Drill all the way through an open hole or all the way to bottom of blind hole, making sure hole is straight and that centerline of hole is not moved in drilling process. (Series of photos provided by Heli-Coil Corp., Danbury, Conn.)

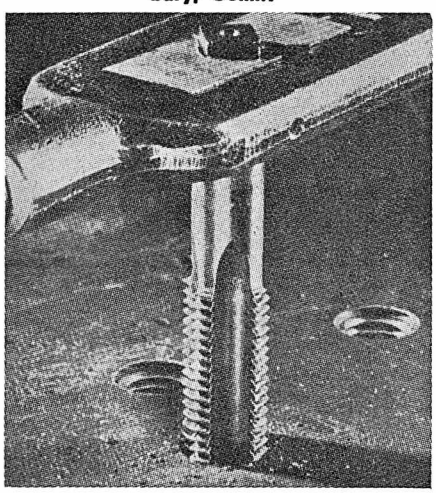


Fig. 2-27—Special drill taps are provided in thread repair kit for threading drilled hole to correct size for outside of thread insert. A standard tap cannot be used.

Heli-Coil thread repair kits are available through the parts departments of most engine and equipment manufacturers; the thread inserts are available in most of the common thread sizes and types.

FASTENER THREADS

Due to the international manufacturing and usage, servicing will require a knowledge of the different types of fastener threads in current use. The normal precaution of making sure threads match before applying force to the fastener must be followed. Due to recent changes in some thread standards, "eyeballing" different fasteners to match threads is virtually impossible and the fasteners must be mated more than one or two turns to detect a difference. A trial fit should always be used when there is any doubt as to threads matching.

Currently, three thread systems are the basis for threaded parts manufactured internationally. They are: the Inch-Thread System, the Whitworth Thread System and the Metric Thread System. The Whitworth Thread System is used mainly in Britain. The Inch Thread System is found in countries using the English system of measurement and has been used in a relatively unchanged state for a long period of time. The Metric Thread System has, however, undergone recent changes which should be noted.

Even though the Metric Thread System is based on the metric system of measurement, standards as to thread pitch, depth and diameter have not been internationally consistent. In an effort towards standardization of the Metric Thread System,

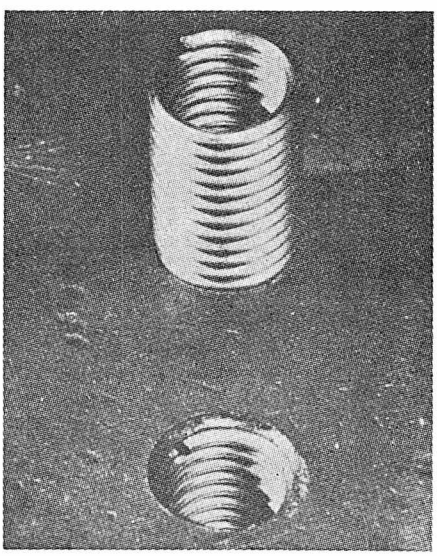


Fig. 2-28—A thread insert and a completed repair are shown above. Special tools are provided in thread repair kit for installation of thread insert.

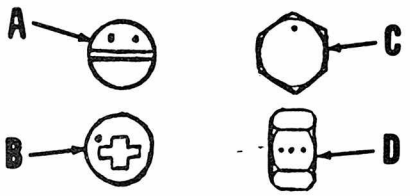


Fig. 2-28A—Marks used by one manufacturer to identify fasteners having ISO Threads. Small dots represent punch or die marks. Slotted screw and set screw marks are shown at (A), Phillips head screw at (B), bolt head at (C) and side view of nut at (D).

the major manufacturing countries of the world have agreed to follow the thread standards set-up by the International Standardization Organization (ISO). In the future, fasteners of the same size having ISO metric threads will be interchangeable irregardless of manufacturing origin. Identification of ISO fasteners may be different between manufacturers, but some identifying marks are similar and one manufacturer's identifying marks are shown in Fig. 2-27A. In addition to thread changes, some bolt head sizes have been changed. Be sure the tool fits the bolt head.

PISTON, RINGS, PIN AND CYLINDER

When servicing pistons, rings and cylinders, it is important that all recommended tolerances be closely observed. Parts that are damaged should be carefully examined to determine the cause. A piston damaged as shown in Fig. 2-29 is obviously not a result of normal wear and if the cause is not corrected, new parts may be similarly damaged in a short time. On this particular piston, the skirt is not scored and the first glance will show melted aluminum which has covered the ring on one side. The melted spot (D) on top and below piston crown is conclusive proof of detonation damage and the cause

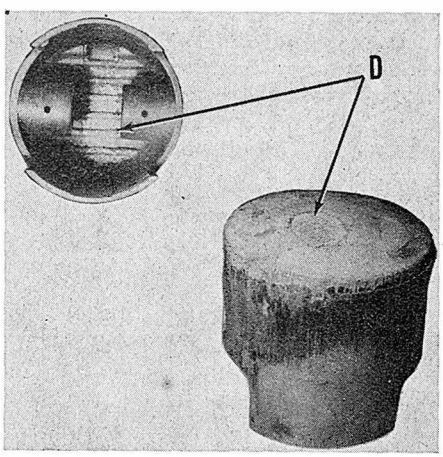


Fig. 2-29—If parts are excessively damaged, cause should be determined and corrected before returning motor to service.

cause must be corrected during overhaul or the same failure can be expected to recur.

If pistons are scuffed or scored, look for metal transfer to cylinder walls. Metal transfer and score marks must be removed from cylinder walls with a hone. Chrome plated cylinder bores should not be honed.

Full strength muriatic acid can be used to remove aluminum deposits from a cast iron cylinder bore. Muriatic acid can be purchased in a drug store. It is also used as a soldering acid, although the supply kept in most radiator shops has usually been cut (diluted) with zinc. Use acid carefully, it can cause painful burns if spilled on the skin and the fumes are toxic. It is most easily used by carefully transferring a small amount to a plastic squeeze bottle, or to another small container and applying with a cotton swab. DO NOT allow the acid to spill or run onto aluminum portions of the cylinder, it will rapidly attack and dissolve the metal. Do not use the acid on a chrome bore. When applied to aluminum deposits, the acid will immediately start to boil and foam. When the action stops the aluminum has been dissolved or the acid is diluted; wipe the area with an old rag or towel which can be discarded. If deposits remain, repeat the process. Flush the area with water when aluminum is removed. Water will dilute the acid and can be used to stop the action if desired, or if acid runs off onto aluminum portion of cylinder, is accidentally spilled, etc. Immediately coat treated portion of cylinder with oil, as the acid makes the cast iron especially susceptible to rust.

A rule of thumb says scuffing or scoring of piston above the piston pin is due to overheating. Damage below the pin is more likely due to insufficient lubrication or improper fit. Overheating may be caused by a lean mixture, overloading, a damaged cooling fan or fins, air leaks in carburetor mounting gasket or manifold, blow-by (stuck or broken rings) as well as carbon build-up.

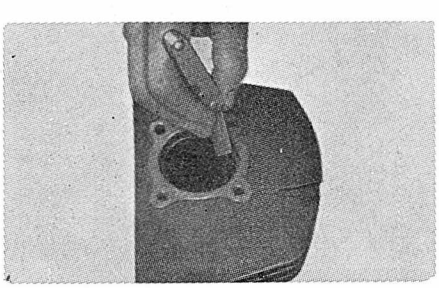


Fig. 2-30 — Gap between ends of ring should be within recommended limits.

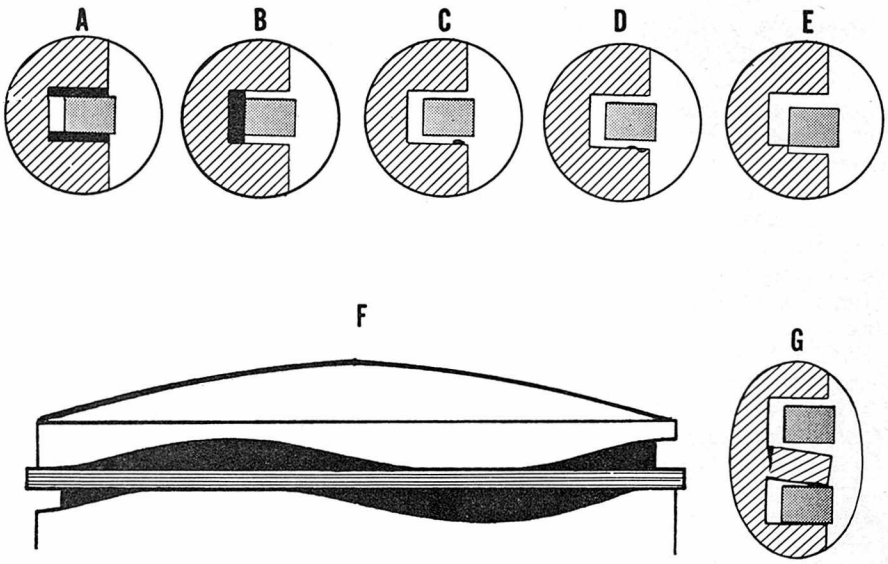


Fig. 2-31—Piston ring grooves must be clean and not damaged to provide a good seal.

A. Carbon on sides of groove may cause ring to stick in groove.

B. Carbon on bottom (back) of groove may prevent rings from compressing.

C & D. Small pieces of carbon (C) or nicks (D) in groove will prevent a good seal.

E. If groove is worn as shown, renew the piston.

F. If groove is not straight, renew piston.

G. Renew piston if ring land is bent.

Before installing new piston rings, check ring end gap as follows: Position the ring near the bottom of cylinder bore. The piston should be used to slide the ring in cylinder to locate ring squarely in bore. Measure the gap between end of ring using a feeler gage as shown in Fig. 2-30. Slide the ring down in the cylinder to the area of transfer and exhaust ports and again measure gap. Rings may break if end gap is too tight at any point; but, will not seal properly if gap is too wide. Variation in gap indicates cylinder wear (usually near the ports and at top of ring travel.

Ring grooves in the piston should be carefully cleaned and examined. Use caution when cleaning to prevent damage to piston. Grooves for Dykes (L rings), Keystone (Both sides angled) and Half Keystone rings are especially easily damaged. Carelessness can result in poor performance and possibly extensive internal engine damage. Refer to Fig. 2-31. When installing rings on piston, expand only far enough to slip over the piston and **do not twist rings.** After installing rings on piston, use feeler gage to measure ring side clearance in groove as shown in Fig. 2-32. Excessive side clearance will prevent an effective seal and may cause rings to break.

On models with cast iron cylinder or cylinder liner, cylinder bore should be honed to remove glaze from cylinder walls before installing new piston rings. Ridge at top and bottom of ring travel should be removed by honing. If ridge is not removed, new rings may catch enough to bend the ring lands as shown at (G—Fig. 2-31). The finished cylinder should have light cross-hatch pattern as shown in Fig. 2-33. After honing, wash cylinder as-

Fig. 2-32—Ring side clearance in groove should be measured with gage as shown. Clearance should be within recommended limits and the same all the way around piston.

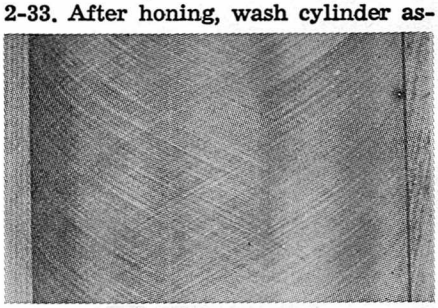


Fig. 2-33—A cross-hatch pattern as shown should be obtained by moving hone up and down cylinder bore as it is being turned by slow speed electric drill.

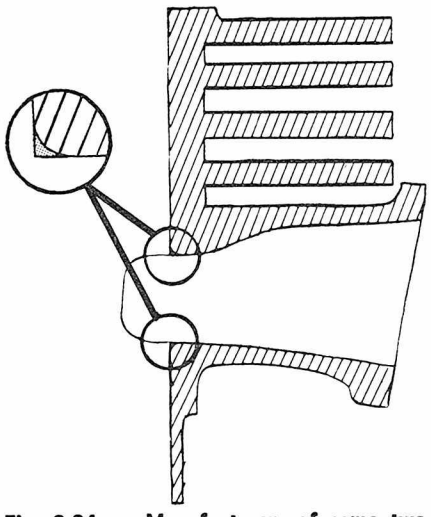


Fig. 2-34 — Manufacturers of some two-stroke cycle engines recommend that top and bottom edges of ports be chamfered (as shown in the inset) after reboring to prevent piston rings from catching on the sharp edges of ports.

sembly with soap and water to remove all traces of abrasive. After cylinder is dry, swab cylinder bore with oil making sure that it is absolutely clean.

NOTE: On models with chrome plated aluminum cylinder bore, the cylinder should not be honed or rebored to an oversize. Chrome plated piston rings should not be installed in chrome cylinder bore.

Some manufacturers have oversize piston and ring sets available for use in repairing engines in which the cylinder bore is excessively worn and standard size piston and rings cannot be used. If care and approved procedures are used in oversizing the cylinder bore, installation of an oversize piston and ring set should result in a highly satisfactory overhaul.

The cylinder bore may be oversized by using either a boring bar or a hone; however, if a boring bar is used it is usually recommended the cylinder bore be finished with a hone. Refer to Fig. 2-33. Before attempting to rebore or hone the cylinder to oversize, carefully measure the cylinder bore to be sure that new, standard size piston and rings will not fit within tolerance. Also, it may be possible that the cylinder is excessively worn or damaged and that reboring or honing to largest oversize will not clean up the worn or scored surface.

Some manufacturers recommend that after boring a cylinder to an oversize, the top and bottom edges of the ports in the cylinder wall be rounded (or beveled) to prevent the rings from catching on sharp port edges. Fig. 2-34 shows typical port cross section with area to be removed shown enlarged at inset.

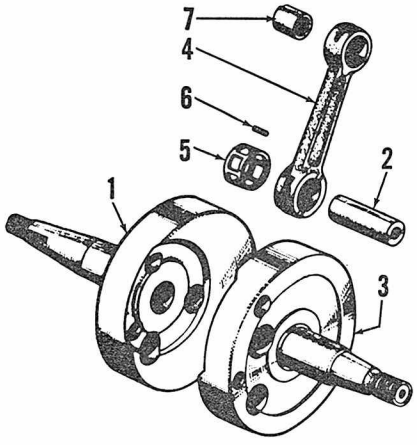


Fig. 2-35—Exploded view of typical press together crankshaft assembly. Many manufacturers have preassembled complete units available as service part.

When assembling piston to connecting rod, observe special precautions outlined in the individual repair sections. The top of the piston is usually marked with an arrow for correct assembly. In addition to positioning ring end gaps so that ends will not catch in ports, the piston pin bore in piston is usually off center. If piston is incorrectly installed, the piston skirt may be broken. Lubricate piston pin bearing (or bushing), piston, rings and cylinder before assembling.

CONNECTING ROD AND CRANKSHAFT

Many of the crankshafts are pressed together and are composed of parts shown in Fig. 2-35. To remove the connecting rod from these units, it is usually necessary to support one of the crankshaft counterweights and press crankpin out. When reassembling, it is necessary to accurately align the crankshaft assembly using a dial indicator and "V" blocks or lathe as shown in Fig. 2-36 or Fig. 2-37. Specification for maximum eccentricity and suggested method of measuring is given, in appropriate REPAIR section for each model.

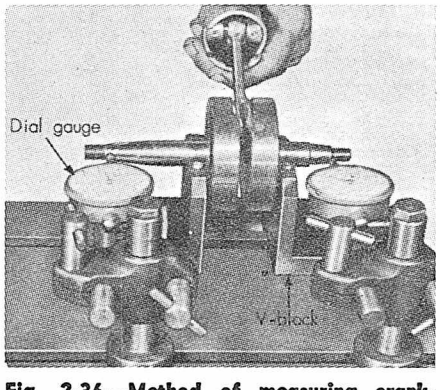


Fig. 2-36—Method of measuring crankshaft run-out (eccentricity) using "V" blocks and dial indicators is shown above.

NOTE: The crankshaft should be disassembled only if the required tools are available to check and align the reassembled crankshaft. On some models, repair parts are not available and the complete assembly is renewed on an exchange basis.

CRANKCASE AND GEARBOX

Most crankcases are composed of two halves which must be separated to remove internal parts. Usually dowel pins are used to align the two halves. The crankshaft bearings, dowel pins, transmission bearings and sealer all hold the two halves tobether and it is sometimes difficult to separate. **Extreme caution should be exercised when separating halves.** The mating surfaces will be difficult to seal if nicked or scarred. The crankshaft may be knocked out of alignment if main bearings are dislodged by pounding on end of crankshaft. Some manufacturers provide special tools for removing (and installing) crankshaft and main bearings from crankcase bores.

During reassembly of the transmission assembly, each gear selection should be engaged and crankshaft (or transmission shaft) rotated to make certain that reassembly is correct **BEFORE** completing the reassembly and installation.

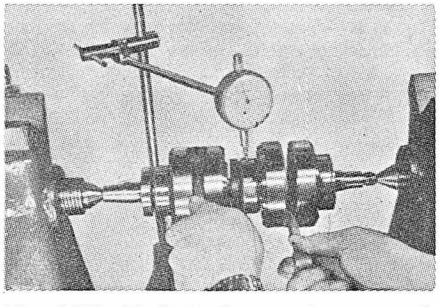


Fig. 2-37—Method of measuring eccentricity with crankshaft mounted between lathe centers using a dial indicator.

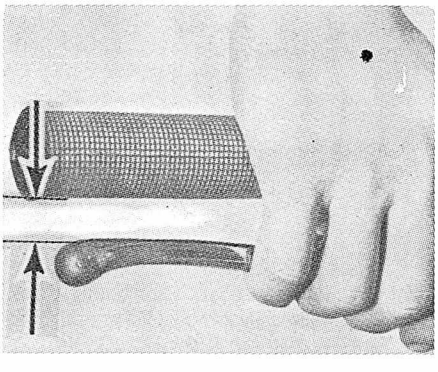


Fig. 2-39 — The front brake hand lever should never contact the hand grip.

FRAME AND COMPONENTS

BRAKES

Front and rear brake action should be checked each time before the motorcycle is ridden. The front brake hand lever should **never** be compressed against hand grip even with brake fully applied. Normal **minimum** suggested clearance (as shown in Fig. 2-39) is approximately ⅞ inch with front brake locked. Adjustment is accomplished at cable adjusters shown in Fig. 2-40 and Fig. 2-41 or at hand lever end of cable. Rear brake pedal should be compressed approximately ⅞ inch (as shown in Fig. 2-42) with rear brake locked. Adjustment is normally accomplished as shown in Fig. 2-41 or 2-43.

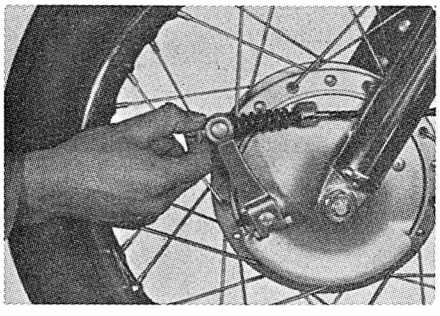


Fig. 2-40—Some models are provided with an adjustment nut as shown at end of front brake cable.

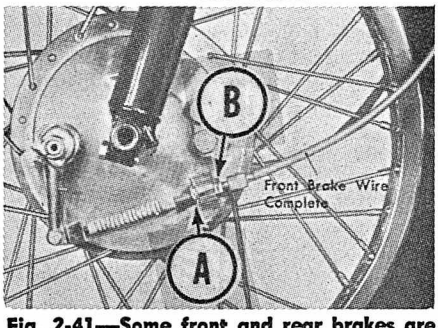


Fig. 2-41—Some front and rear brakes are adjusted at cable guides shown at (B) after locknut (A) is loosened.

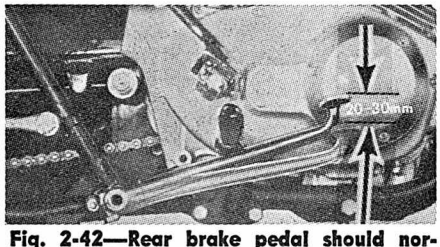


Fig. 2-42—Rear brake pedal should normally lock rear wheel when compressed approximately ⅞ inch.

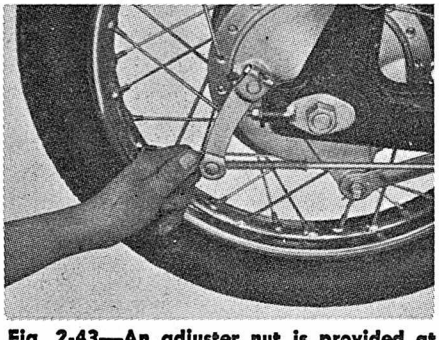


Fig. 2-43—An adjuster nut is provided at end of rear brake rod on some models as shown. Adjustment of other models may be similar to front wheel shown in Fig. 2-41.

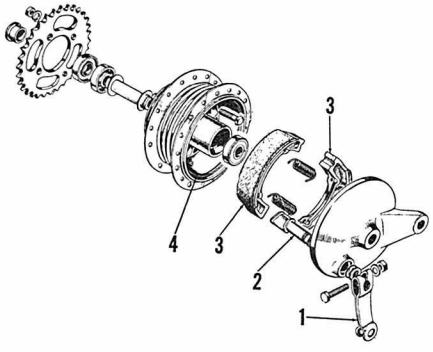


Fig. 2-44—Exploded view of simple rear brake assembly. Front brake may be similar. Lever (1) is actuated by controls and turns cam (2) expanding shoes (3) against drum (4).

When adjusting brakes, setting should not be so tight that wheels are hard to turn with brakes released. Typical exploded views of brake assemblies are shown in Figs. 2-44, 2-45 and 2-46.

On dual cam brakes, rod (5—Fig. 2-45) should be adjusted as follows: Disconnect brake cable from lever (1F) and remove connector pin (6). Adjust length of connector rod (5) until holes from pin (6) in lever (1F) and connector rod (5) are aligned without moving levers (1F and 1R). Reinstall pin (6) and adjust control cable.

CHAIN

Servicing drive chains consists of cleaning, lubricating, tightening, aligning and replacement. Improper maintenance and neglect not only shortens chain life but also contributes to sprocket wear.

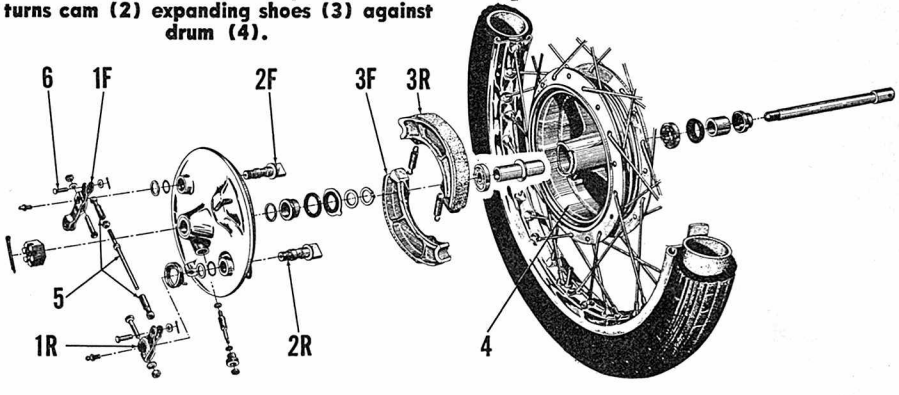
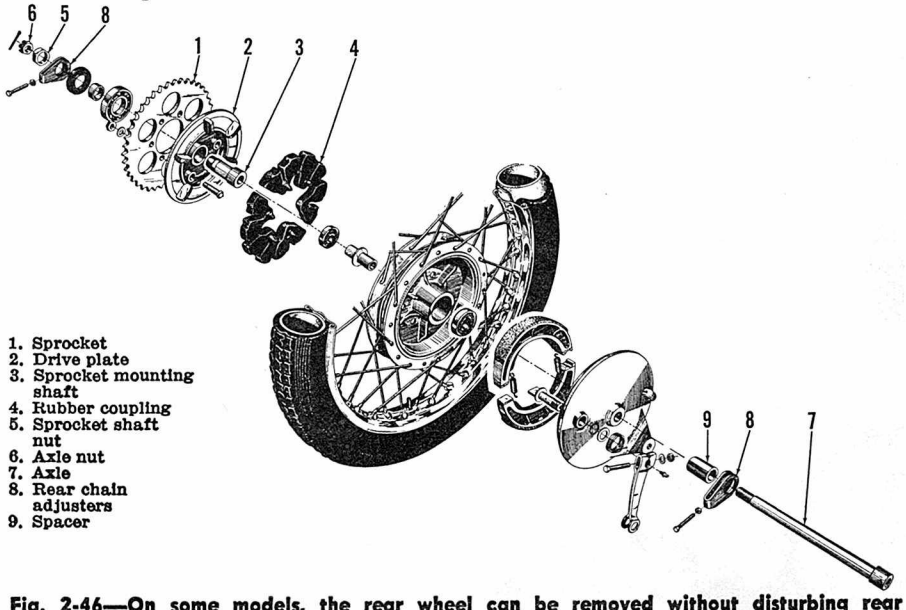


Fig. 2-45—Exploded view of dual cam (full self-energizing) front brake assembly. This type is used on rear on some models. Front lever (1F) is actuated by hand control lever and turns cam (2F) expanding brake shoe (3F). Rod (5) connects the two levers together so that rotation of lever (1F) will also rotate lever (1R).



1. Sprocket
2. Drive plate
3. Sprocket mounting shaft
4. Rubber coupling
5. Sprocket shaft nut
6. Axle nut
7. Axle
8. Rear chain adjusters
9. Spacer

Fig. 2-46—On some models, the rear wheel can be removed without disturbing rear sprocket (1). Lugs on drive plate (2) fit into coupling (4) in wheel.

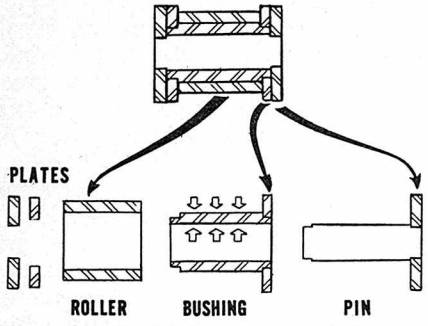


Fig. 2-47—The lubricant must work between the plates to enter bearing areas (white arrows) on each side of bushing. Occasional immersion is the only satisfactory way of assuring complete lubrication.

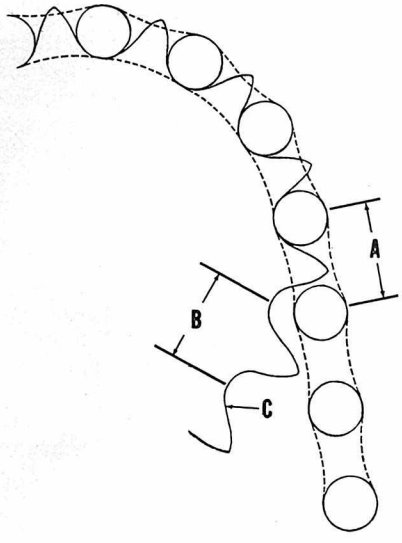


Fig. 2-48—Chain pitch (A) must exactly equal sprocket pitch (B) to prevent excessive wear on bearing edge of sprocket tooth (C). Refer to text.

The rear chain should periodically be removed and cleaned then lubricated with a commercial chain grease. Lubricant for the bushing area (White Arrows—Fig. 2-47) must work into bushing between the close fitting side plates and immersion is the most satisfactory way of assuring complete lubrication. Most of the chain lubricants require heating to thin the grease and allow the lubricant to enter all surfaces of the chain.

Sprocket tooth profile is precisely ground to fit the roller diameter and chain pitch, Refer to Fig. 2-48. When chain and sprocket are new, the chain moves around the sprocket smoothly with a minimum of friction, and the load is evenly distributed over several sprocket teeth. Wear on pins and bushings of a roller chain results in a lengthening or "stretch" of each individual chain pitch as well as a lengthening of the complete chain. The worn chain, therefore, no longer perfectly fits the sprocket. Each roller contacts the sprocket tooth higher up

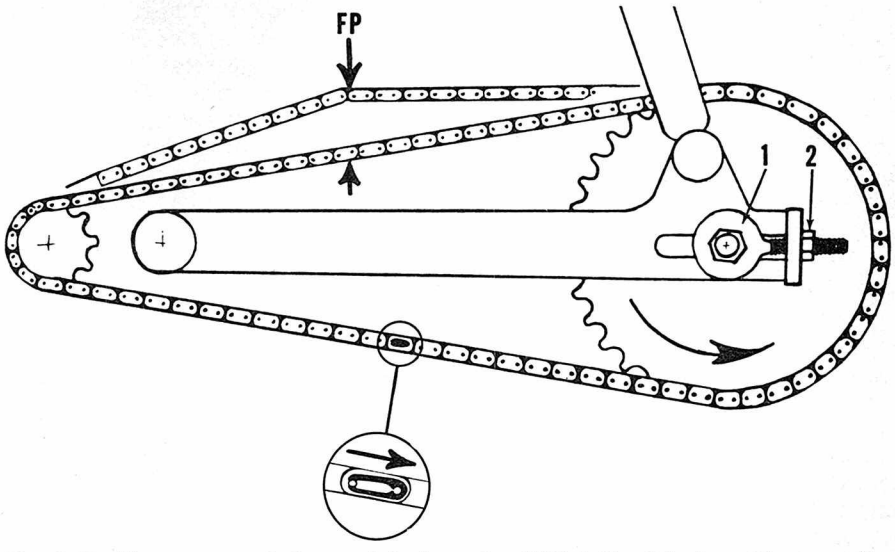


Fig. 2-49—The recommended rear chain free play (FP) is listed in the table preceeding each maintenance section. Inset shows correct master link installation.

Fig. 2-50—Exploded view of typical single row drive chain.

on the bearing area (C) and that tooth bears the total load until the next tooth and roller make contact. Chain wear will therefore quickly result in increased sprocket wear.

As a rule of thumb, the chain should be inspected periodically and renewed whenever chain stretch exceeds 2% (or ¼-inch per foot). Check sprockets carefully for wear if chain wear is substantially greater than 2%, and renew sprockets if in doubt. Sprocket wear usually shows up as a hooked tooth profile. A good test is to fit the sprocket to a new chain. Wear on sides of sprocket indicates misalignment. If sprockets must be renewed because of wear, always renew the chain. Early failure can be expected if a new chain is mated with worn sprockets or new sprockets with a worn chain.

The rear chain is usually tightened by an adjuster similar to the one

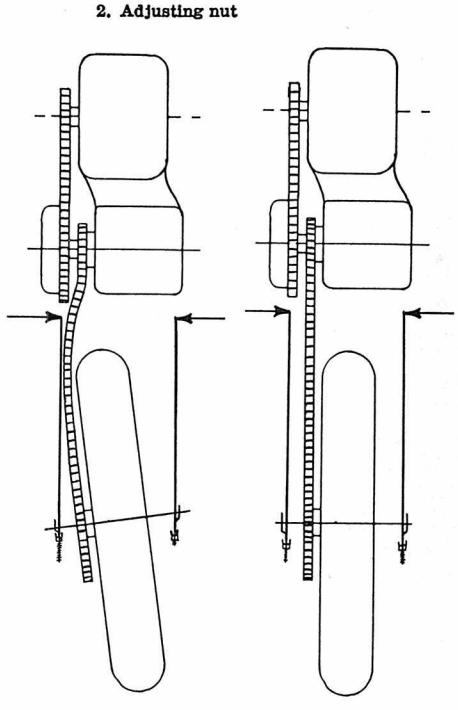


Fig. 2-51—The rear chain should be adjusted to provide correct chain alignment as shown in the right view.

shown at (1—Fig. 2-49) located at each end of the rear axle. The adjuster located on the side of the chain provides most of the chain tightening, however every time the chain free play is adjusted, the sprocket alignment must also be checked. Improper alignment will subject the chain to side load and rapid wear and sprocket will show wear on sides of teeth. Free play should be measured midway between sprockets as shown at (FP—Fig. 2-49). Recommended rear chain free play is listed in the table preceding MAINTENANCE section of

each model. Adjusters on both sides of axle should be tightened to provide correct free play and align sprockets. Refer to Fig. 2-51.

Adjustment procedure for primary chain on models so equipped is outlined in MAINTENANCE section for that model.

WIRE WHEELS

Particular attention should be applied to the maintenance of wire wheels. Spokes should be checked for tightness periodically and any missing, bent or broken spokes renewed. The condition of the wheel hub should also be noted. The load of the motorcycle and rider is taken by the top spokes as the wheel revolves. Each spoke is designed to accept a part of the load, but as spokes are damaged, an unequal amount of the load is carried by other spokes which may eventually cause wheel failure.

Spoke tightness should be checked occasionally by gently hitting a metal object, such as a screwdriver, against each spoke. If the spokes are tightened evenly, each spoke, when hit, will produce a sound with a pitch approximately the same as the rest of the spokes. Tighten spokes with a spoke wrench until the same approximate pitch is heard on all spokes.

Single spokes may be renewed without dismounting wheel if rim and hub are not damaged. Release a small amount of air but do not flatten tire. Remove hooked end of spoke from hub, cut spoke to remove it if not already broken. Unscrew spoke from nipple being careful not to force nipple into rim. Insert replacement spoke through hub and attach to nipple. Spoke may be slightly bent on installation but should pull straight when tightened. New spoke should be checked for tightness after a few hours of run in time.

Most wheels are equipped with two different types of spokes, commonly called inner and outer spokes (Fig. 2—52). Outer spokes (A) tend to have more of a right angle bend while inner spokes (B) have a smaller angle bend. Inner and outer spokes are identical on some wheels but on units where the spokes are different they must be installed correctly.

If rim is bent or hub is broken, it will be necessary to remove and disassemble wheel. Before dismantling wheel, pay special attention to pattern of spoke lacing. There are several ways to lace wheels and sometimes wheels will be laced two different ways on the same motorcycle. When dismantling wheel, segregate inner and outer spokes and place spoke nipples in a container of light oil or solvent to aid reassembly.

Place hub on work bench and install outer, then inner spokes of top rib on hub (Fig. 2—53). Carefully invert hub and install remaining spokes. Placing hub close to edge of work bench will ease installation (Fig. 2—54). After installing all spokes and placing them in the approximate pattern they will be in, place wheel rim in position.

Examination of rim will show that spoke holes are drilled at various angles to match different angles at which spokes meet wheel.

Working with one row at a time, install all spoke nipples one or two turns or just enough to hold them in place. Wheel is ready to be trued.

Mount wheel on an axle and place in a vice or a suitable stand that will allow wheel to rotate freely. Begin by gradually tightening inner spokes a few turns at a time, constantly checking for eccentricity. Gradually decrease the amount each spoke is tightened each revolution of the wheel. High spots on rim may be isolated by gradually moving a grease pencil or other marker toward rim from outside. Loosen spokes opposite high spot ½-turn each and tighten spokes next to high spot ½ turn each. Wipe away mark and recheck.

When all eccentricity is removed, gradually tighten outer spokes in the same manner. Bring marker in from side to check for side-to-side play. Loosen spokes pulling rim off center and tighten adjacent spokes to help bring rim toward center. When wheel is completely aligned strike each spoke with a small metal object to make certain that none have been left loose.

Any portion of spoke protruding past nipple into rim should be ground off to prevent tire damage.

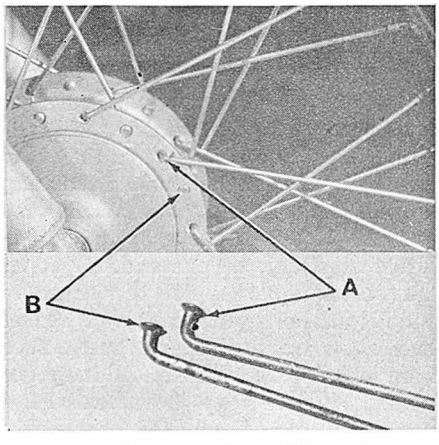


Fig. 2-52—Inner spokes (B) and outer spokes (A) may have different radius bend at head.

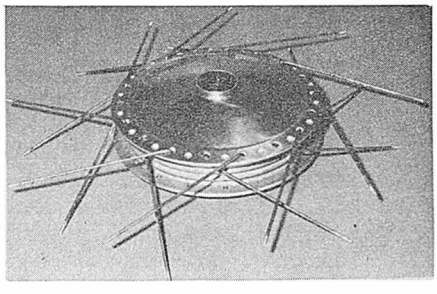


Fig. 2-53—Place inner and outer spokes in one side of rim and then invert wheel and install remaining spokes.

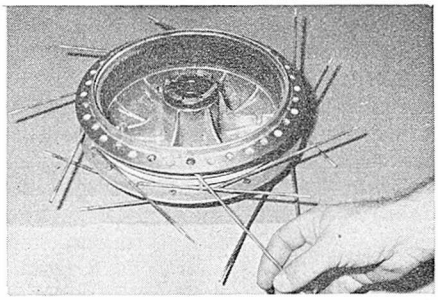


Fig. 2-54—Positioning hub near edge of bench will ease spoke installation.

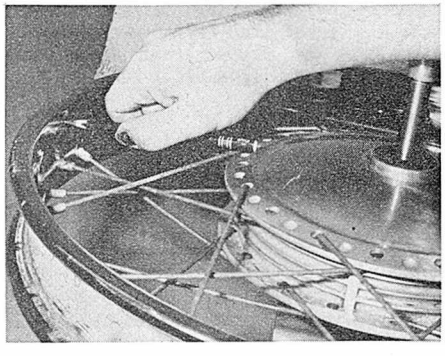


Fig. 2-55—Move grease pencil from inside to detect out of round condition.

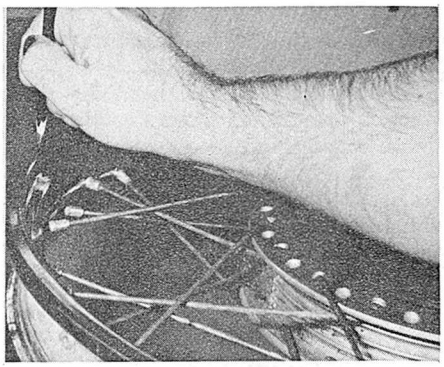


Fig. 2-56—Move grease pencil from side of rim to detect side to side play.

SPEED TUNING

Procedures and specifications for modifying individual engines are included in some of the engine service sections. These modifications may be accomplished with varying degrees of success. Before any alterations are started, several things must be considered.

1. The life of an original production engine is usually longer (if maintained properly) than a modified engine.
2. Clearances and settings for all parts must be maintained more closely on modified engines than on original production engines, not only to increase performance but to prevent extensive damage.
3. It may be necessary to change drive ratio and in some cases entire assemblies in the drive train in order to operate the engine at its "tuned" RPM range or to insure the life of drive train components.
4. Under NO circumstances should work be started without a thorough knowledge of what and why it is being done.
5. Make certain that the correct tools are used. Port modification, etc; may result in less power and/or destruction of an engine if improperly or carelessly done.
6. Any modification will void manufacturer's warranty.

The data included in the individual engine service sections is generally not the ultimate in modifications and is not intended to be. The changes listed are made available only after the manufacturer has completed extensive tests and is convinced the modifications are safe and practical.

Many motorcycles can be modified to increase performance for the type of riding for which it was designed; however, it is more difficult to change its intended use (such as a trials model into a road racer).

The following outlines commonly used modification. Modification may be accomplished on some models by altering original parts or by installing different parts available from the manufacturer or other source. In many cases, all modifications will not be necessary or recommended.

SPARK PLUG

A colder (heat range) spark plug than original equipment should usually be installed. The spark plug should be the coldest which can be run without fouling. Under racing conditions, the correct spark plug will depend upon ambient temperature, length of race and type of race as well as the engine condition and type. The correct heat range may be too cold for operation until engine has been started and warmed up. If the correct plug for racing conditions fouls before engine reaches normal temperature, use a hotter plug (such as original equipment type) to start and warm up the engine. If the spark plug is too cold, the plug will foul without causing excessive damage; however, the engine may be damaged if plug heat range is too high.

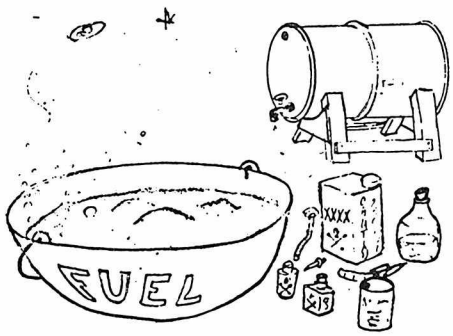


Fig. 3-1—Some fuel mixtures can be used successfully, but be careful when experimenting.

Make certain that the correct reach (thread length) and thread type (SAE or ISO) is selected. In some cases, it may be necessary to install different thickness spark plug gasket or two gaskets in order to have correct heat range and reach. Booster gap spark plugs are not recommended for most racing applications.

FUEL SYSTEM

The fuel system should receive careful consideration. Make certain that fuel fittings, lines and filters do not restrict fuel flow causing lean mixture at high speed.

If a different carburetor is installed, extreme care should be exercised. It is possible to install a carburetor that is too large on most engines. Some carburetor changes will cause "flat spots" at various RPM, loss of torque (especially at low RPM), hard starting or extensive engine damage from incorrect fuel-air mixture. When selecting a different carburetor, make certain that it is correct for your application. Carburetor and engine manufacturers are usually very helpful.

When adjusting mixture, a slightly rich setting is more desirable than a lean mixture. Check condition of fuel filters and fuel lines if mixture can not be set too rich at high RPM. Air leaks in crankcase will also cause lean mixture, especially at low RPM.

Fuels other than gasoline or additives for use with gasoline should be used with extreme caution. A great many different chemicals will aid performance, but many increase engine temperature and/or require a much richer fuel to air ratio. Sometimes the standard fuel lines will not supply enough volume, drilled passages and jets must be enlarged and some fuels will corrode or otherwise damage fuel system parts. Several commonly used fuels will not mix with petroleum based oils and some require the use of an ester to mix with a lubricant.

IGNITION SYSTEM

Various ignition system changes are possible, including total loss battery ignition, capacitor discharge, energy transfer, etc. The system that seems to work for one engine tuner with one make (or model) of engine in one type of race may not be at all satisfactory to another. One thing common to all systems used for racing is that the ignition system must be maintained in much better condition than required for lower speed, lighter load applications.

On most engines, the original production timing will be correct or nearly correct. If ignition timing is to be advanced beyond original setting, begin with the original setting then slowly and carefully experiment with different timing. Excessive spark advance can destroy an engine very quickly.

CYLINDER HEAD

The cylinder head should usually be modified. The effective compression ratio is determined by displacement when the piston closes the exhaust port, not total displacement when piston is at Bottom Dead Center. If the exhaust port is raised, the effective compression ratio will be lowered and power may decrease if

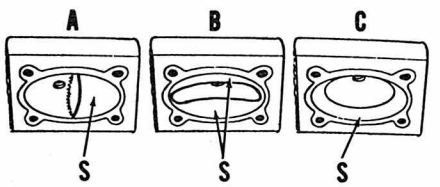


Fig. 3-2—Drawing showing typical cylinder heads. Type "A" has squish area (S) only on one side. Type "B", sometimes called a trench type head, has squish areas (S) on two sides. Type "C" is hemispherical with squish area (S) completely around edge.

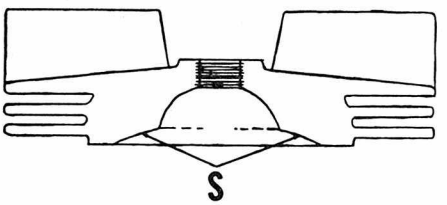


Fig. 3-3—If the cylinder head is milled, the squish area (S) must be changed also. Clearance between piston and squish area should be the same as original.

the cylinder head is not changed also. Some cylinder heads are manufactured to be used in combination with the raised exhaust port. If these cylinder heads are used on standard cylinder (with lower exhaust port), the edge of cylinder (C—Fig. 3-2), may decrease.

Many cylinder heads have a squish area (part of the cylinder head is very close to piston at Top Dead Center). The part of the cylinder head closest to piston may be all around the edge of cylinder (C—Fig. 3-2), only one side of cylinder (A) or on two sides (B). The squish area is provided to cause turbulence of the gaseous mixture for more complete burning. It is very important that the original clearance between low part of cylinder head and piston be maintained if the cylinder head is modified. If only the lower surface of cylinder head is milled, the piston will probably hit the cylinder head. If the squish area is also machined, but not enough material was removed (resulting in too little squish clearance), the engine may not run properly because of localized hot spots and/or trapped pockets of the gaseous mixture. Squish area should usually be machined to follow the original contour and clearance. Make certain that squish clearance is continued to the edge of the cylinder bore.

It is not necessary to polish the combustion chamber surface to a mirror finish; however, all sharp edges should be removed to prevent hot spots which might cause pre-ignition.

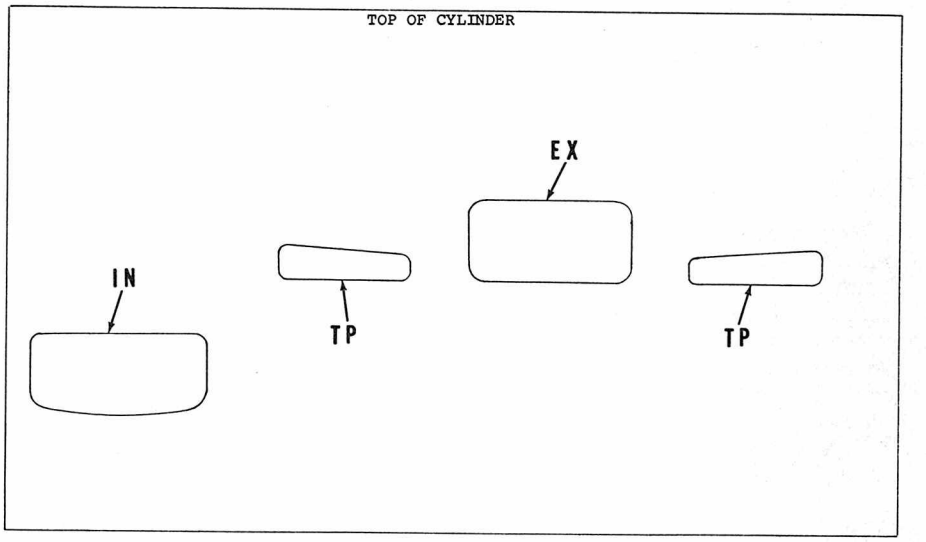


Fig. 3-5—A pattern of the original ports in cylinder should be made before changing any of the openings. Radii of the corners and edges are difficult or impossible to draw in the cylinder without a pattern.

CYLINDER

Use extreme caution when modifying the cylinder in any way. The inlet, transfer and exhaust ports and passages are carefully designed and manufactured originally, and even more care should be exercised when changing them. The gases are timed by the vertical location of the ports in cylinder wall. Direction and velocity of flow is controlled by the width of ports and size and shape of the passages. If modification is sloppy or incorrect, power may be less than with original cylinder.

Carefully inspect the removed cylinder. Note the cylinder material and condition of cylinder bore. The three types of cylinders generally used are cast iron, aluminum with iron sleeve and aluminum with hard chrome plating in bore. A worn out or damaged cylinder should not be modified unless it can be repaired. If cast iron or aluminum with cast iron sleeve type cylinder is to be rebored to larger size, the cylinder should be resized before modifying ports. Refer to PISTON paragraphs for fitting piston.

Modification of cylinder made of cast iron or aluminum with cast iron sleeve can be accomplished by using a rotary grinder if carefully done. Work slowly and carefully, using as fine a stone as practical. A stone which is too coarse will have a tendency to work into one area, will be difficult to control and will result in rough irregular shapes. On some models with aluminum cylinder and cast iron sleeve, the cylinder can be heated, old sleeve removed and new chilled sleeve pressed into place. Make certain that all ports and passages are aligned when installing new sleeve.

Aluminum cylinder with hard chrome bore is normally found on higher performance models and extensive modification is not necessary. If any changes are made, be especially careful or the chrome plating will be ruined and the cylinder will be useless. DO NOT bore or hone aluminum cylinder with hard chrome plated bore. Additional clearance between piston and cylinder can be accomplished by carefully finishing the piston. Refer to PISTON paragraphs for fitting piston to cylinder. If small amounts of material from piston have stuck to chrome cylinder bore, they can be removed by hand sanding. Very carefully sand diagonally as shown in Fig. 3-13. Using #400 or #600 sandpaper with oil or gasoline. Sand only by hand and stop when piston material is removed. DO NOT DAMAGE the chrome plating.

Before any grinding is done, examine original ports and note location, size and shape. Location and shape of ports can be transferred to paper positioned in cylinder bore and gently pressed against all of the port openings and top and bottom edges of cylinder bore. Be sure that paper does not move or an incorrect pattern will result. If carefully done, the removed paper should be marked similar to Fig. 3-5. All suggested radii are difficult (or impossible) to draw in the cylinder and if first drawn on paper pattern can be more easily transferred to the cylinder.

Changes in port sizes and shapes should be drawn on inside of cylinder bore before grinding. Coat the area where changes are to be made with

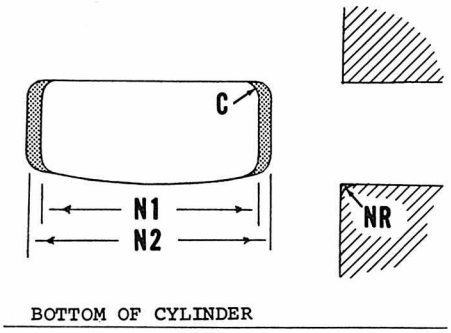


Fig. 3-6—Increasing the width of inlet port will only increase size and will not change timing. The lower edge (NR) should usually be rounded or beveled to prevent piston skirt from catching.

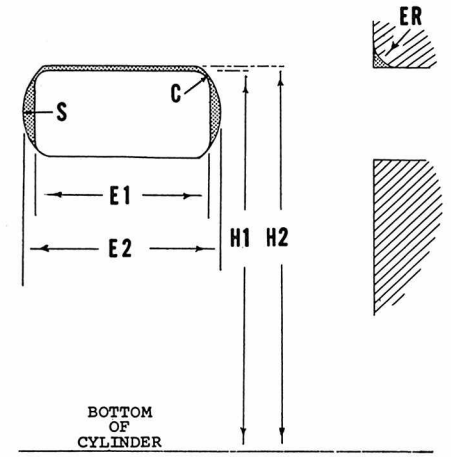


Fig. 3-7—Raising the exhaust port in cylinder will cause port to open sooner. If port modifications are incorrect, rings will probably catch and cause extensive damage. Radius (S) at sides and rounded edge (ER) guide rings back into grooves.

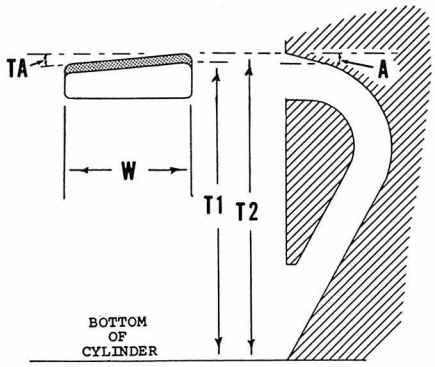


Fig. 3-8—Raising the transfer ports will cause ports to open sooner. Angles of passage (A) and port (TA) direct fuel into cylinder and should be closely maintained.

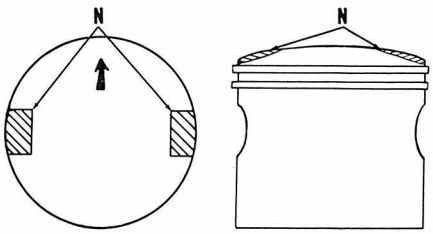


Fig. 3-9—If manufacturer recommends cutting the piston (N) to advance transfer port timing, use extreme care. Depth of cut will weaken piston and possibly damage piston rings.

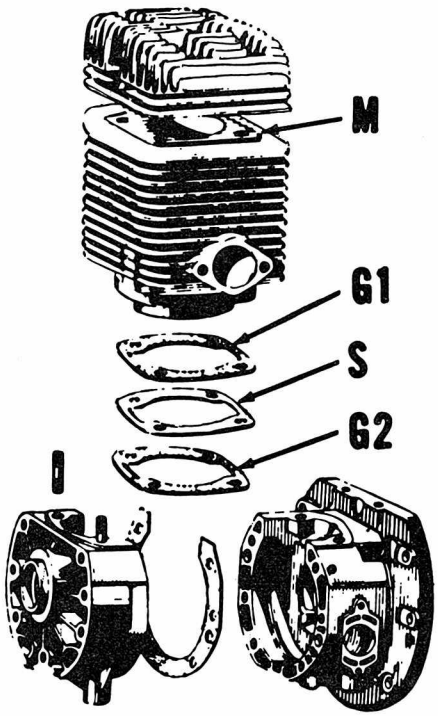


Fig. 3-10—Sometimes a spacer (S) is installed below cylinder to raise the transfer ports. Be sure to note that all ports (inlet and exhaust as well as transfer ports) will be raised. A second gasket (G2) should be used below spacer and combined thickness of spacer (S) and gasket (G2) is the amount that cylinder is raised. The amount that cylinder is raised should be machined from top of cylinder (M).

machinist dye or similar material, then scratch lightly through the coating to show material to be removed. In most cases, a pattern of the modified port will facilitate marking.

The inlet port and exhaust port are usually the easiest to work with and should be done first. On loop scavenged engines, modification to only one of the transfer ports and/or passages (or unequal modification to all transfer ports and passages) will prevent correct balance and possibly direction of the incoming fuel-air mixture. The result is usually reduced power and increased fuel consumption.

The inlet port (IN—Fig. 3-5), on piston ported models, is opened as the piston skirt moves toward the upper part of the cylinder. Advanced inlet timing (open sooner) and increased duration (stays open longer) can be accomplished on most models by cutting part of the piston skirt off. Lowering the bottom edge of port will also advance inlet timing and increase duration and is sometimes recommended. Advancing inlet timing on piston ported engines will also cause the port to close later resulting in less compression in the crankcase. Changing the width (Fig. 3-6) of inlet port only increases size. On most models, the lower edge of inlet port should be rounded slightly (NR) to prevent the piston skirt from catching on edge.

The inlet passage from carburetor to inlet port should be smoothed and in some cases be enlarged. Make certain that carburetor, gaskets, heat shields, adapters, etc. are all aligned and passage through these parts and into inlet passage is smooth. Any misalignment will cause turbulence and restriction resulting in less power.

The exhaust port (EX—Fig. 3-5) is often raised and enlarged (width increased). Certain precautions must be taken or results will be totally unsatisfactory. Raising the exhaust port will cause it to open sooner and close later. While this is often desirable, raising the port will decrease compression of the fuel-air mixture before ignition, decrease the length of time for burning after top dead center and decrease the length of the power stroke. Within limits and with other modifications, raising the exhaust port can sometimes increase power. The limits suggested by the manufacturer should usually be considered the safe maximum. If width of exhaust port is increased, the piston rings may expand into and catch in the port. On some engines, the exhaust port is bridged to hold the rings, on some of the top edge is rounded or beveled (ER—Fig. 3-7) and on some the sides of the ports are tapered or round (S) to guide the ring back into the grooves. Many engines use a combination of ways to hold and guide the rings out of the exhaust port. Extensive damage is sure to result if the rings catch in the exhaust port and the engine will probably not run long enough to determine whether power was increased or not. Width should not be increased beyond suggested limits.

The transfer ports (TP—Fig. 3-5) are usually difficult to reach in order to modify and the transfer passages (usually cast with the cylinder) are even more difficult. Some suggest that the piston be notched (Fig. 3-9) or spacer (S—Fig. 3-10) be installed between cylinder and crankcase as alternate methods of advancing transfer port timing. The method suggested in the individual engine section should be followed. If the transfer ports and passages are reshaped; be sure that they are all alike and correct. The angle (A—Fig. 3-8) of

the inlet passage and port (TA) determines the direction of the fuel-air charge entering the cylinder if incorrect, fuel will be wasted and the cylinder will not be cleared of old gases. The transfer passage in crankcase, gasket, cylinder, and sometimes piston skirt, should be matched to provide smooth, nonrestrictive flow. Refer to Fig. 3-11.

Modifications to cylinder such as addition of transfer ports (fifth porting, gully porting, etc.) should usually be discouraged. When performed by an experienced shop, these modifications may increase performance, but should be considered risky.

PISTON

Special performance pistons, using thin rings, "L" rings, etc. are available from many sources including some of the engine manufacturers. The rings used on high performance pistons are designed to resist fluttering at high engine speeds. If the special pistons and rings are available, installation is usually advisable.

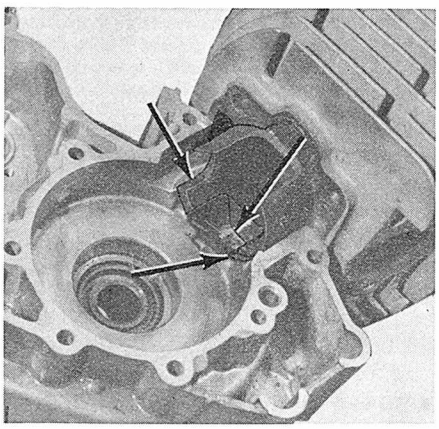


Fig. 3-11—The cylinder should match with crankcase openings. Arrows indicate locations of possible misalignment.

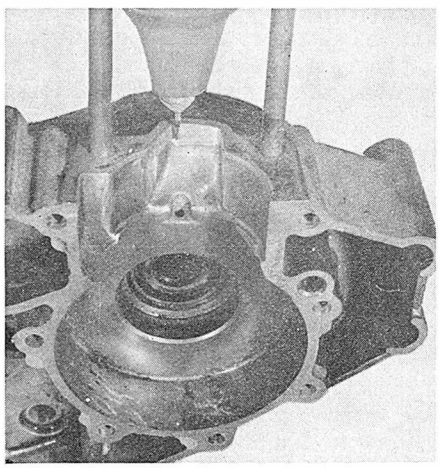


Fig. 3-11A—All bearings should be removed when correcting misalignment of passages. Make certain that all parts are completely cleaned before assembling.

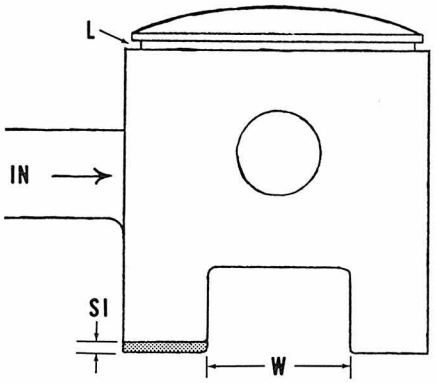


Fig. 3-12—Some pistons designed for high speed operation use an "L" shaped ring. Cutting bottom edge of piston skirt (SI) off will cause inlet port (IN) to open sooner. Slot (W) in lower edge of piston should match with similar openings in cylinder with piston at Bottom Dead Center.

NOTE: Never install chrome plated rings in chrome plated cylinder bore. Do not install "L" ring and piston in cylinder bore which has been operated with standard type ring unless cylinder is rebored to remove old ridge.

On most engines with piston port inlet, the inlet timing is advanced and inlet duration increased by removing part of the piston skirt (SI—Fig. 3-12) that covers the inlet port. Only a small amount of the lower edge should be removed on most engines. If piston is marked for installation in the cylinder (nearly all are marked), make sure that piston is cut correctly. If the piston has windows (W) in lower edges which align with the lower end of transfer passages, they should not partially block the passages. After cutting the piston, be sure to round off all sharp edges and corners.

Any modifications to piston (welding, drilling holes, etc.) should be considered risky. Some modifications involving these techniques may be successful when accomplished by experienced personnel but should not be attempted without considering the risk.

The piston to cylinder clearance on high performance engines should usually be more than on standard production models. If cylinder material was originally cast iron and was changed to aluminum with hard chrome bore, the clearance when cold may be less.

The piston should be fitted as follows, if new piston and/or cylinder is installed: Run the machine at partial RPM and partial load for a **short** time (approximately 5 to 10 minutes), then remove cylinder and piston. Check the piston for any localized

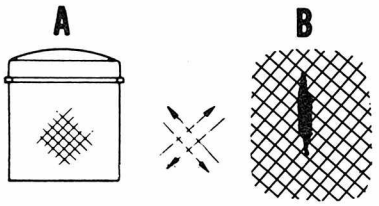


Fig. 3-13—Refer to text for fitting piston to cylinder (A) and for removing material transferred to cylinder bore (B).

high spots which is indicated by polished (bright) surface. If the piston contacts cylinder wall it will be polished. Smooth any polished surface of piston carefully by hand using #400 or #600 sand paper. Refer to B—Fig. 3-13. Also check the cylinder for deposits of aluminum transferred from the piston. If deposits are present, sand diagonally as shown at (A—Fig. 3-13) very carefully using #400 or #600 sandpaper with oil. Sand only by hand and stop when piston material (aluminum) is removed. Thoroughly clean and reassemble. The machine should be run (gradually increasing RPM and load), disassembled, checked and fitted (sanded) as many times as required to perfectly fit the piston to cylinder. Do not remove too much material from piston at one time. Do not run engine too long, too fast or at too much RPM and load. The preceding is in addition to the normal piston fitting to provide a more controlled break-in, not as a substitute for fitting the piston to cylinder at initial assembly.

Piston damage can be caused by incorrect piston to cylinder clearance, improper lubrication, incorrect ring clearances, incorrect ignition timing, detonation, incorrect fuel-air mixture, pre-ignition, incorrect piston to cylinder head clearance, incorrect shape or size of ports, etc. As many safety precautions as possible should be taken when first running, such as slightly rich fuel-air mixture slightly rich lubrication, ignition timing not overly advanced, installation of cold plug. As running time increases, the optimum settings can be established.

ROTARY VALVE

The rotary inlet valve can be modified to provide different opening and closing than standard; however, several precautions should be noted.

Use extreme care when modifying a standard rotary valve. The valve may be weakened and (especially if operated at higher than standard rpm) valve may fly apart causing extensive damage. Some motorcycle manufacturers (and other sources)

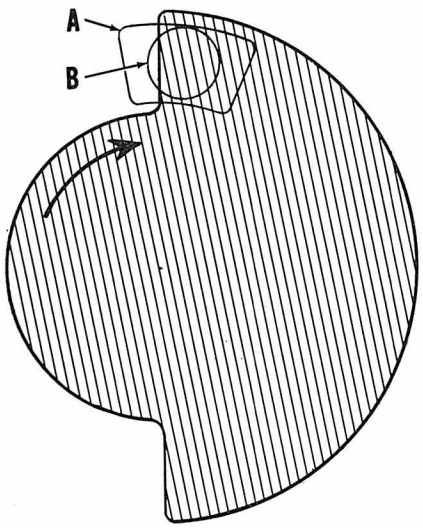


Fig. 3-14—The rotary valve opening begins when passage in crankcase (A) and passage in rotary valve cover (B) are both uncovered. Round port openings such as shown at (B) cause more gradual opening and closing than square port as shown at (A).

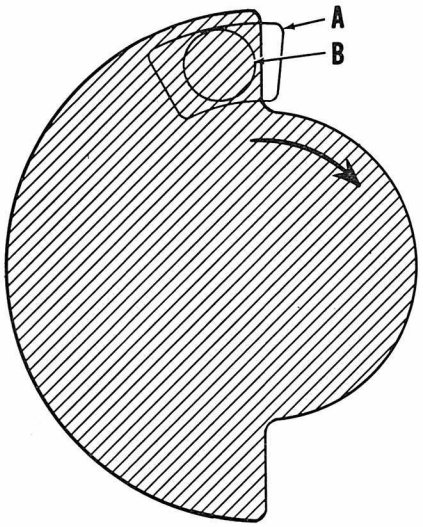


Fig. 3-15—The rotary valve is closed when one of the ports is completely covered. Usually opening (B) in rotary valve cover is smaller and is the first covered.

offer rotary valves with timing (cutaway) different than standard. These high speed rotary valves usually operate more safely than modified standard units.

The rotary valve is sandwiched between the crankcase and a cover. Inlet opens when rotary valve begins to uncover **both** openings (in crankcase and rotary valve cover). Refer to Fig. 3-14. Valve is closed, when **one** of the openings (usually the opening in rotary valve cover first) is completely covered by the rotary valve. Refer to Fig. 3-15.

Changing the width of openings in crankcase and rotary valve cover can change the inlet timing. Changing the height of the openings can prevent

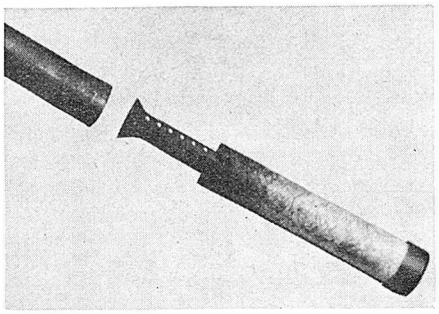


Fig. 3-16—Horsepower may be increased without an increase in noise. View of "Hooker Exhaust Tuner" with fiberglass wrapped perforated stinger core.

valve from sealing. Careful matching of port openings in crankcase and rotary valve cover to each other and to the rotary valve may result in better performance.

SEALING

Many products are available for sealing around grommets, wires, hoses and covers to prevent entrance of water and/or dust. For many types of riding, it is advisable to raise the entrance for air to the carburetor (air cleaner), ignition compartment vent, transmission vent and clutch compartment vent. Hoses attached to the vent tubes can be routed to a higher location.

EXHAUST TUNING

One of the most interesting and effective tools for tailoring the performance of a two stroke engine is the "Tuned Exhaust" or "Expansion Chamber". Technically, the two terms are not interchangeable, but because of common usage they have come to have a similar meaning. A third term related to exhaust design but not interchangeable with the other two is "Silencing". It might be worthwhile at this point to briefly define the terms as they are used here.

EXPANSION CHAMBER. There are three reasons why the exhaust gases of a two stroke engine are not released directly into the atmosphere. Two of these reasons, "Noise Control" and "Flame Suppression" apply to the entire family of engines whether they are two stroke, four stroke or rotating combustion type. The third reason "Performance Improvement" applies mainly to two stroke engines. Any enclosed area including a muffler or silencer, into which the exhaust empties is properly called an expansion chamber. But in common usage the term applies mainly to those units which improve performance.

A TUNED EXHAUST carries the performance oriented expansion chamber one step further and makes use of the reflected sound wave to further improve performance.

MUFFLERS are expansion chambers which quiet exhaust noise. Most motorcycle standard exhaust systems are carefully matched to the engine in order to increase power as well as reducing noise level. Removal of muffler or muffler parts (baffles) will nearly always decrease performance. Some racing expansion chambers are designed with a silencer built in the outlet pipe (stinger) or with provision for adding a silencer to the outlet pipe.

OPERATION. In the exchange cycle of a two stroke engine, the exhaust gases are removed from the cylinder and the cylinder recharged from the crankcase for the next cycle. Efficiency and power will be greatest when this exchange is completed at the highest possible cylinder pressure as the exhaust ports close. It should be remembered that, at 6000 rpm the complete operating cycle occurs 100 times a second and the exchange cycle occupies only about 60% of the total cycle. Therefore the exchange takes place in the smallest fraction of a second.

During the exchange cycle of an engine equipped with an expansion chamber, several events occur simultaneously; a rise of pressure in the expansion chamber, the exchange of gasses in the cylinder, and the lowering of pressure in the crankcase. If the first and last events are properly balanced, complete exchange of gases is accomplished at a pressure equal to or above ambient atmospheric pressure. The higher the pressure (or the denser the fresh charge) the greater the horsepower output. If the expansion chamber is too small, improperly designed, or the outlet partially blocked, there will be incomplete exchange of gases in the cylinder, some exhaust gas will remain and output will suffer. If the expansion chamber is too large (not designed for the engine) no improvement is gained.

It should be remembered that a cylinder ported engine is symmetrical in design. An exhaust port that is uncovered at 110° after TDC on the power stroke will be closed 110° before TDC on the compression stroke. The exhaust port must open before the transfer ports, and therefore must close after the transfer ports close. "Exhaust Tuning" attempts to hold the pressure in the cylinder above that of the outside air when the exhaust ports close to trap the charge. The principle involve is the same as

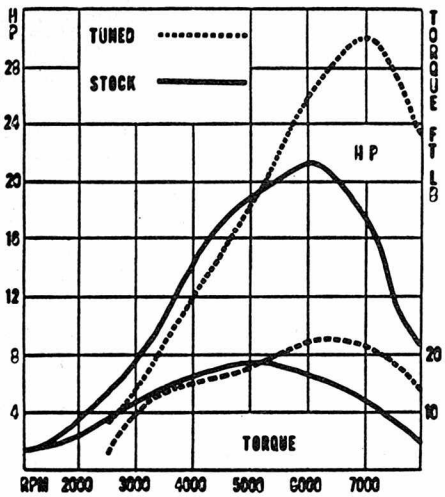


Fig. 3-18 — Advetised horsepower and torque curves of a 250 cc single cylinder motorcycle showing performance variations obtainable.

that which produces the echo when sound is directed toward a distant object. When the exhaust port opens on a two cycle engine, the escaping gases create an explosive noise which enters the expansion chamber with the exhaust gas. The main force of the sound wave travels straight outward until it escapes or is reflected by the expansion chamber walls. A TUNED exhaust returns the reflected sound wave to the exhaust ports while the ports are still open and after the transfer ports have closed. The sound wave is accompanied by a pressure rise which reverses the outflow of scavenging gases at the exhaust ports as they are closing, thus increasing the density of the fuel mixture in the cylinder. Exhaust tuning is effective through a relatively narrow range of engine operation and the area of improvement can be detected from the sound and feel of engine performance. To be fully effective, exhaust tuning should be accompanied by other changes, including carburetion, port timing and induction. Fig. 3-18 shows that advertised performance curves of a stock and factory tuned 250cc single cylinder motorcycle engine. The effect of tuning is most apparent by the reverse bend of the torque curve at 5000 rpm and by the wide divergence of the two horsepower curves at the upper end.

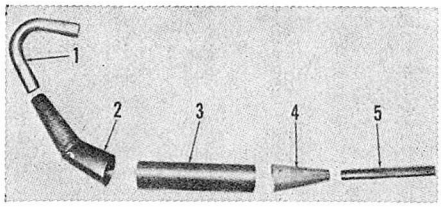


Fig. 3-19—The expansion chamber shown can be welded together of separate pieces. Specifications for header pipe (1), divergent cone (2), chamber body (3), convergent cone (4) and stinger (5) are included in text for individual models.

CONSTRUCTION. Specifications are included in specific Speed Tuning sections for building expansion chambers for individual models. Construction is sometimes difficult; however, units are available which are ready to bolt onto many popular motorcycle models. Some of the expansion chambers available are manufactured from stampings (Fig. 3-19A) which permit the chamber to curve smoothly around engine and frame components without causing restrictions.

Others are manufactured from cones and cylinders which are welded together to create the expansion chamber (Fig. 3-19).

SPECIAL NOTES

It is important that all screws and nuts be secured, using safety wire, lock plates, lock washers, self-locking nuts or locking compound (such as LOCTITE). All parts should be checked often for security.

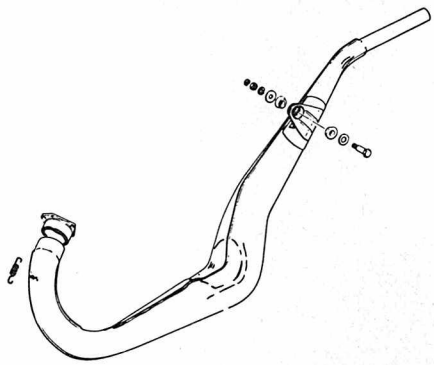


Fig. 3-19A—Drawing of a typical factory expansion chamber. Units are usually stamped and conform to fit closely to specific models.

Be extremely careful when filling the fuel tank. Filters should be used to prevent foreign matter from entering tank. Check the fuel filters on vehicle at regular intervals and renew units when in doubt, to prevent lean mixture from damaging engine.

SUMMARY

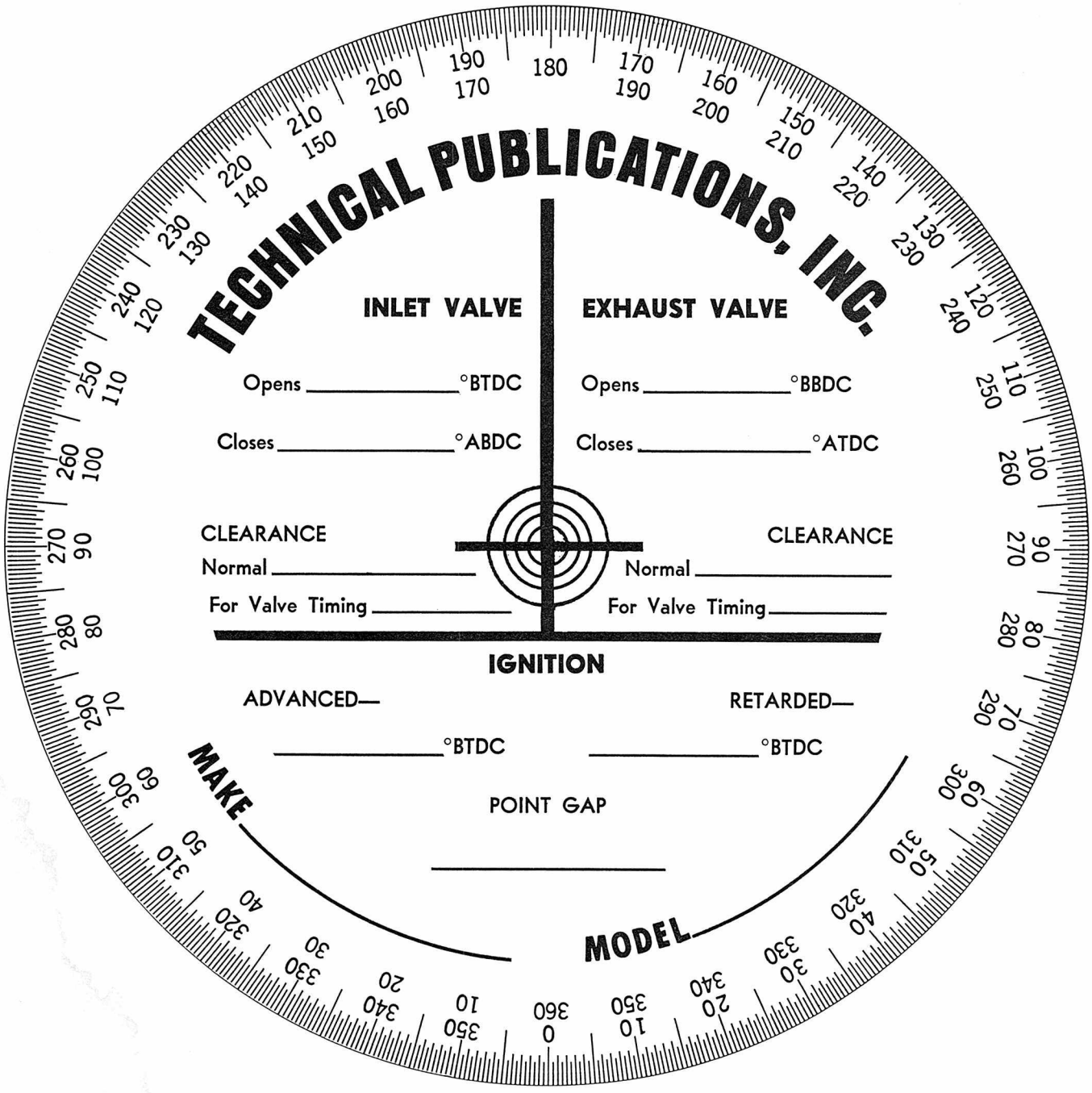
The expected results of engine modifications are more torque and more RPM. The materials used to manufacture motorcycle engines do have a stress limit at which point any given part will fail. It is much easier to exceed the limits of the materials after modification and much more caution should be exercised. As an example, it may be impossible to exceed the RPM limit (Red Line) in any gear except first before modification; however after modification the RPM limit may be exceeded in the lower three gears. It is also possible that the suspension components will not withstand the increased strains.

The end result of full race tuning is outstanding performance over a relatively narrow operating range. There will be corresponding sacrifices in service life, operating economy, ease of starting and dependability.

MM.	INCHES			MM.	INCHES			MM.	INCHES			MM.	INCHES			MM.	INCHES			MM.	INCHES		
1	0.0394	1/32	+	51	2.0079	2.0	+	101	3.9764	3 31/32	+	151	5.9449	5 15/16	+	201	7.9134	7 29/32	+	251	9.8819	9 7/8	+
2	0.0787	3/32	−	52	2.0472	2 1/16	−	102	4.0157	4 1/32	−	152	5.9842	5 31/32	+	202	7.9527	7 15/16	+	252	9.9212	9 29/32	+
3	0.1181	1/8	−	53	2.0866	2 3/32	−	103	4.0551	4 1/16	−	153	6.0236	6 1/32	−	203	7.9921	8.0	−	253	9.9606	9 31/32	−
4	0.1575	5/32	+	54	2.1260	2 1/8	+	104	4.0945	4 3/32	+	154	6.0630	6 1/16	+	204	8.0315	8 1/32	+	254	10.0000	10.0	
5	0.1969	5/16	+	55	2.1654	2 5/32	+	105	4.1339	4 1/8	+	155	6.1024	6 3/32	+	205	8.0709	8 1/16	+	255	10.0393	10 1/32	+
6	0.2362	1/4	−	56	2.2047	2 7/32	−	106	4.1732	4 3/16	−	156	6.1417	6 5/32	−	206	8.1102	8 1/8	−	256	10.0787	10 1/32	−
7	0.2756	9/32	−	57	2.2441	2 1/4	−	107	4.2126	4 7/32	−	157	6.1811	6 3/16	−	207	8.1496	8 5/32	−	257	10.1181	10 1/8	−
8	0.3150	5/16	+	58	2.2835	2 9/32	+	108	4.2520	4 1/4	+	158	6.2205	6 7/32	+	208	8.1890	8 3/16	+	258	10.1575	10 5/32	+
9	0.3543	11/32	+	59	2.3228	2 5/16	+	109	4.2913	4 9/32	+	159	6.2598	6 1/4	+	209	8.2283	8 7/32	+	259	10.1968	10 3/16	+
10	0.3937	13/32	−	60	2.3622	2 3/8	−	110	4.3307	4 11/32	−	160	6.2992	6 5/16	−	210	8.2677	8 9/32	−	260	10.2362	10 1/4	−
11	0.4331	7/16	−	61	2.4016	2 13/32	−	111	4.3701	4 3/8	−	161	6.3386	6 11/32	−	211	8.3071	8 5/16	−	261	10.2756	10 9/32	−
12	0.4724	15/32	+	62	2.4409	2 7/16	+	112	4.4094	4 13/32	+	162	6.3779	6 3/8	+	212	8.3464	8 11/32	+	262	10.3149	10 5/16	+
13	0.5118	1/2	+	63	2.4803	2 15/32	+	113	4.4488	4 7/16	+	163	6.4173	6 13/32	+	213	8.3858	8 3/8	+	263	10.3543	10 11/32	+
14	0.5512	9/16	−	64	2.5197	2 17/32	−	114	4.4882	4 1/2	−	164	6.4567	6 15/32	−	214	8.4252	8 7/16	−	264	10.3937	10 13/32	−
15	0.5906	19/32	−	65	2.5591	2 9/16	−	115	4.5276	4 17/32	−	165	6.4961	6 1/2	−	215	8.4646	8 15/32	−	265	10.4330	10 7/16	−
16	0.6299	5/8	+	66	2.5984	2 19/32	+	116	4.5669	4 9/16	+	166	6.5354	6 17/32	+	216	8.5039	8 1/2	+	266	10.4724	10 15/32	+
17	0.6693	21/32	+	67	2.6378	2 5/8	+	117	4.6063	4 19/32	+	167	6.5748	6 9/16	+	217	8.5433	8 17/32	+	267	10.5118	10 1/2	+
18	0.7087	23/32	−	68	2.6772	2 11/16	−	118	4.6457	4 21/32	−	168	6.6142	6 5/8	−	218	8.5827	8 19/32	−	268	10.5512	10 9/16	−
19	0.7480	3/4	−	69	2.7165	2 23/32	−	119	4.6850	4 11/16	−	169	6.6535	6 21/32	−	219	8.6220	8 5/8	−	269	10.5905	10 19/32	−
20	0.7874	25/32	+	70	2.7559	2 3/4	+	120	4.7244	4 23/32	+	170	6.6929	6 11/16	+	220	8.6614	8 21/32	+	270	10.6299	10 5/8	+
21	0.8268	13/16	+	71	2.7953	2 25/32	+	121	4.7638	4 3/4	+	171	6.7323	6 23/32	+	221	8.7008	8 11/16	+	271	10.6693	10 21/32	+
22	0.8661	7/8	−	72	2.8346	2 27/32	−	122	4.8031	4 13/16	−	172	6.7716	6 25/32	−	222	8.7401	8 3/4	−	272	10.7086	10 23/32	−
23	0.9055	29/32	−	73	2.8740	2 7/8	−	123	4.8425	4 27/32	−	173	6.8110	6 13/16	−	223	8.7795	8 25/32	−	273	10.7480	10 3/4	−
24	0.9449	15/16	+	74	2.9134	2 29/32	+	124	4.8819	4 7/8	+	174	6.8504	6 27/32	+	224	8.8189	8 13/16	+	274	10.7874	10 25/32	+
25	0.9843	31/32	+	75	2.9528	2 15/16	+	125	4.9213	4 29/32	+	175	6.8898	6 7/8	+	225	8.8583	8 27/32	+	275	10.8268	10 13/16	+
26	1.0236	1 1/32	−	76	2.9921	3.0	−	126	4.9606	4 31/32	−	176	6.9291	6 15/16	−	226	8.8976	8 29/32	−	276	10.8661	10 7/8	−
27	1.0630	1 1/16	+	77	3.0315	3 1/32	+	127	5.0000	5.0		177	6.9685	6 31/32	−	227	8.9370	8 15/16	−	277	10.9055	10 29/32	−
28	1.1024	1 3/32	+	78	3.0709	3 1/16	+	128	5.0394	5 1/32	+	178	7.0079	7.0	+	228	8.9764	8 31/32	+	278	10.9449	10 15/16	+
29	1.1417	1 5/32	−	79	3.1102	3 1/8	−	129	5.0787	5 3/32	−	179	7.0472	7 1/16	−	229	9.0157	9 1/32	−	279	10.9842	10 31/32	+
30	1.1811	1 3/16	−	80	3.1496	3 5/32	−	130	5.1181	5 1/8	−	180	7.0866	7 3/32	−	230	9.0551	9 1/16	−	280	11.0236	11 1/32	−
31	1.2205	1 7/32	+	81	3.1890	3 3/16	+	131	5.1575	5 5/32	+	181	7.1260	7 1/8	+	231	9.0945	9 3/32	+	281	11.0630	11 1/16	+
32	1.2598	1 1/4	+	82	3.2283	3 7/32	+	132	5.1968	5 3/16	+	182	7.1653	7 5/32	+	232	9.1338	9 1/8	+	282	11.1023	11 3/32	+
33	1.2992	1 5/16	−	83	3.2677	3 9/32	−	133	5.2362	5 1/4	−	183	7.2047	7 7/32	−	233	9.1732	9 5/16	−	283	11.1417	11 5/32	−
34	1.3386	1 11/32	−	84	3.3071	3 5/16	−	134	5.2756	5 9/32	−	184	7.2441	7 1/4	−	234	9.2126	9 7/32	−	284	11.1811	11 3/16	−
35	1.3780	1 3/8	+	85	3.3465	3 11/32	+	135	5.3150	5 5/16	+	185	7.2835	7 9/32	+	235	9.2520	9 1/4	+	285	11.2204	11 7/32	+
36	1.4173	1 13/32	+	86	3.3858	3 3/8	+	136	5.3543	5 11/32	+	186	7.3228	7 5/16	+	236	9.2913	9 9/32	+	286	11.2598	11 1/4	+
37	1.4567	1 15/32	−	87	3.4252	3 7/16	−	137	5.3937	5 13/32	−	187	7.3622	7 3/8	−	237	9.3307	9 11/32	−	287	11.2992	11 5/16	−
38	1.4961	1 1/2	−	88	3.4646	3 15/32	−	138	5.4331	5 7/16	−	188	7.4016	7 13/32	−	238	9.3701	9 3/8	−	288	11.3386	11 11/32	−
39	1.5354	1 17/32	+	89	3.5039	3 1/2	+	139	5.4724	5 15/32	+	189	7.4409	7 7/16	+	239	9.4094	9 13/32	+	289	11.3779	11 3/8	+
40	1.5748	1 9/16	+	90	3.5433	3 17/32	+	140	5.5118	5 1/2	+	190	7.4803	7 15/32	+	240	9.4488	7 7/8	+	290	11.4173	11 13/32	+
41	1.6142	1 5/8	−	91	3.5827	3 9/16	−	141	5.5512	5 9/16	−	191	7.5197	7 17/32	−	241	9.4882	9 1/2	−	291	11.4567	11 15/32	−
42	1.6535	1 21/32	−	92	3.6220	3 5/8	−	142	5.5905	5 19/32	−	192	7.5590	7 9/16	−	242	9.5275	9 17/32	−	292	11.4960	11 1/2	−
43	1.6929	1 11/16	+	93	3.6614	3 21/32	+	143	5.6299	5 5/8	+	193	7.5984	7 19/32	+	243	9.5669	9 9/16	+	293	11.5354	11 17/32	+
44	1.7323	1 23/32	+	94	3.7008	3 11/16	+	144	5.6693	5 21/32	+	194	7.6378	7 5/8	+	244	9.6063	9 19/32	+	294	11.5748	11 9/16	+
45	1.7717	1 25/32	−	95	3.7402	3 3/4	−	145	5.7087	5 23/32	−	195	7.6772	7 11/16	−	245	9.6457	9 21/32	−	295	11.6142	11 5/8	−
46	1.8110	1 13/16	−	96	3.7795	3 25/32	−	146	5.7480	5 3/4	−	196	7.7165	7 23/32	−	246	9.6850	9 11/16	−	296	11.6535	11 21/32	−
47	1.8504	1 27/32	+	97	3.8189	3 13/16	+	147	5.7874	5 25/32	+	197	7.7559	7 3/4	+	247	9.7244	9 23/32	+	297	11.6929	11 11/16	+
48	1.8898	1 7/8	+	98	3.8583	3 27/32	+	148	5.8268	5 13/16	+	198	7.7953	7 25/32	+	248	9.7638	9 3/4	+	298	11.7323	11 23/32	+
49	1.9291	1 15/16	−	99	3.8976	3 29/32	−	149	5.8661	5 7/8	−	199	7.8346	7 27/32	−	249	9.8031	9 13/16	−	299	11.7716	11 25/32	−
50	1.9685	1 31/32	−	100	3.9370	3 15/16	−	150	5.9055	5 29/32	−	200	7.8740	7 7/8	−	250	9.8425	9 27/32	−	300	11.8110	11 13/16	−

NOTE. The + or − sign indicates that the decimal equivalent is larger or smaller than the fractional equivalent.

NOTES



The above degree wheel should be attached to a suitable stiff backing and used to check valve and ignition timing. Center hole must be cut out and degree wheel can be attached to end of crankshaft. Attach pointer to an engine bolt and align with degree marks. If Top Dead Center is not marked, the following procedure may be used. Insert a depth gage in spark plug hole and turn crankshaft CLOCKWISE until piston just contacts the gage. Move the degree wheel (crankshaft stopped) until 0 degree mark is aligned with the pointer. Turn the crankshaft COUNTER-CLOCKWISE until the piston again contacts the depth gage. Set the crankshaft halfway between the two points (in the unused angle) which will be TDC. Adjust the degree wheel, without moving crankshaft, until 0 degree mark is aligned with pointer. Later maintenance may be facilitated by scribing mark on flywheel and crankcase to indicate TDC.

NOTES

20895 $5.95
(In Canada $7.25)